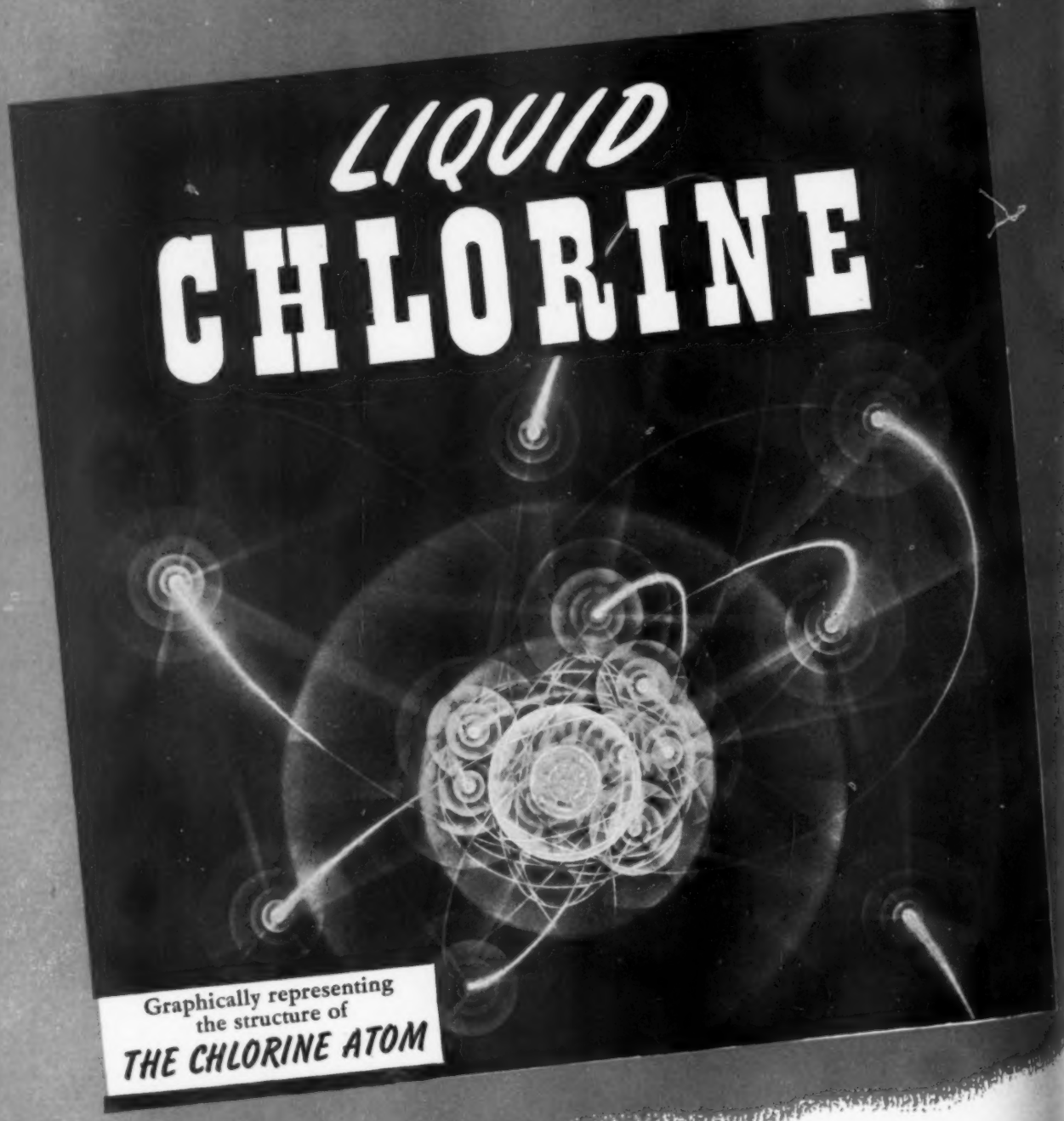
WATER & SEWAGE WORKS

PURIFICATION PLANT OF THE JAMESTOWN R. I. WATER CO.

PENN SALT

LIQUID
CHLORINE



Graphically representing
the structure of
THE CHLORINE ATOM

PENN SALT LIQUID CHLORINE is valuable in water purification, swimming pool sanitation, sewage treatment, slime prevention and control. Write for full information.

OTHER PENN SALT PRODUCTS INCLUDE

Anhydrous Ammonia
Filter Alum
Ferric Chloride
Sodium Aluminate
Chloride of Lime
Caustic Soda
Perchloron

PENNSYLVANIA SALT
MANUFACTURING COMPANY
Chemicals

1000 WIDENER BUILDING, PHILADELPHIA 7, PA.

NEW YORK • CHICAGO • ST. LOUIS • PITTSBURGH • CINCINNATI • MINNEAPOLIS • WYANDOTTE • TACOMA

WATER AND SEWAGE WORKS, November, 1946, Volume 93, Number 11. Published monthly by Gillette Publishing Co., 22 West Maple St., Chicago 10, Ill. Per copy, 25c. Subscription rate, United States, $2.00 per year; Canada, $2.00 per year; Foreign, $3.00 per year. Entered as Second Class Matter, March 12, 1946, at the Post Office at Chicago, Ill., under act of March 3, 1879.

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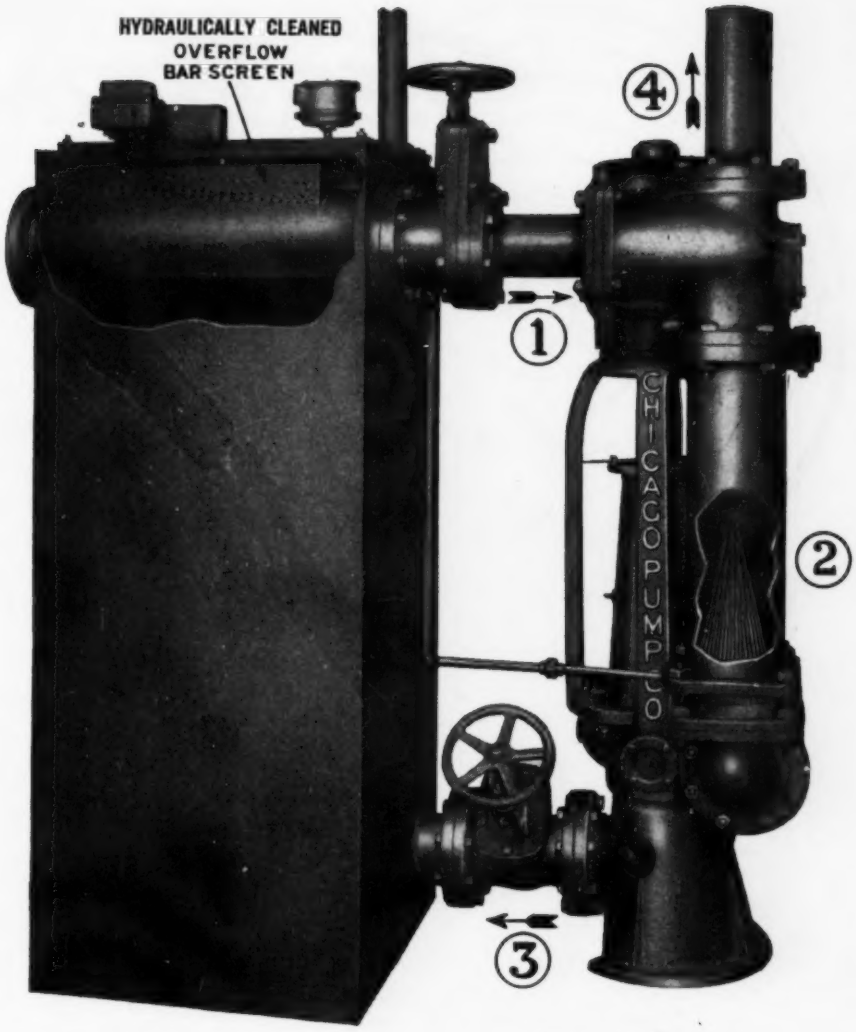
NEW FLUSH-KLEEN DEVELOPMENT

SINGLE "PACKAGED" UNIT

CLOG-PROOF SEWAGE PUMP FOR SMALL OUTLYING LIFT STATIONS 50 GPM OR LESS

(Standard Duplex Flush-Kleens Installed for Larger Flows)



Thoroughly dependable. Requires no attention, except periodic lubrication.

Cannot clog, because sewage solids do not reach pump impeller.

Overall dimensions only 4' 10⅛" x 2' 2⅝".

Second unit can be added any time, to make a duplex installation, by dividing the flow with a Y-fitting.

Water-tight tank prevents leakage.

Pump discharges 75 to 100 GPM to assure rapid cycle of operation to keep strainer clean.

Economical in first cost and high in efficiency.

Ask for Bulletin 122-S.

FILLING WET WELL

① Sewage flows through inlet pipe.
② Sewage solids are retained by strainer.
③ Strained sewage flows through idle pump to basin.

PUMPING

③ Strained sewage is pumped from basin.
② Sewage solids are backwashed from strainer.
④ Special check valve closes; sewage and solids are pumped to sewers.

NOTABLE, EXCLUSIVE CONTRIBUTIONS TO SEWAGE TREATMENT

"PACKAGE" PLANTS
SWING DIFFUSERS
COMMINUTORS
FLUSH-KLEENS
SCRU-PELLERS

CHICAGO PUMP COMPANY

SEWAGE EQUIPMENT DIVISION

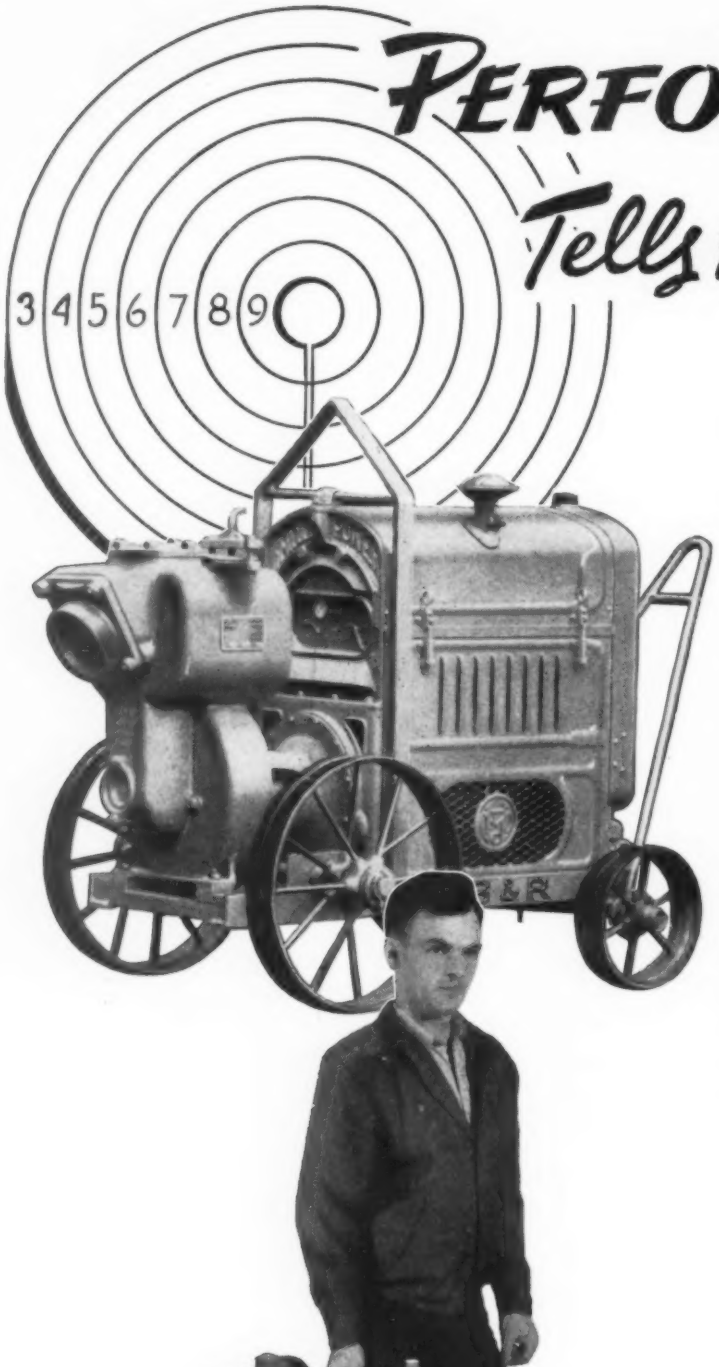
2349 WOLFRAM STREET — CHICAGO 18, ILLINOIS

Flush Kleen, Scru-Peller, Plunger, Horizontal and Vertical Non-Clogs, Water Seal Pumping Units, Samplers.

Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.

PERFORMANCE!

Tells more than Words



For size of pump, for power consumed, for dollar invested, Gorman-Rupp pumps will out-perform any other pump. This is a "put up or shut up" proposition for we are willing to let you prove this for yourself by a free trial with no strings attached.

There is a Gorman-Rupp pump to fit any job. If you want a handy all purpose pump as easy to carry as a bag of tools, the sturdy little "Midget" will fill the bill. It will deliver as much as 3000 gallons per hour at continuous performance. If you have a heavy dewatering job that calls for as much as 125,000 gallons per hour get a Gorman-Rupp heavy duty model pump.
Gorman-Rupp self-priming centrifugal pumps never have to be shut down to be cleaned out -- there is no recirculation orifice to get plugged nor control valve to get jammed.

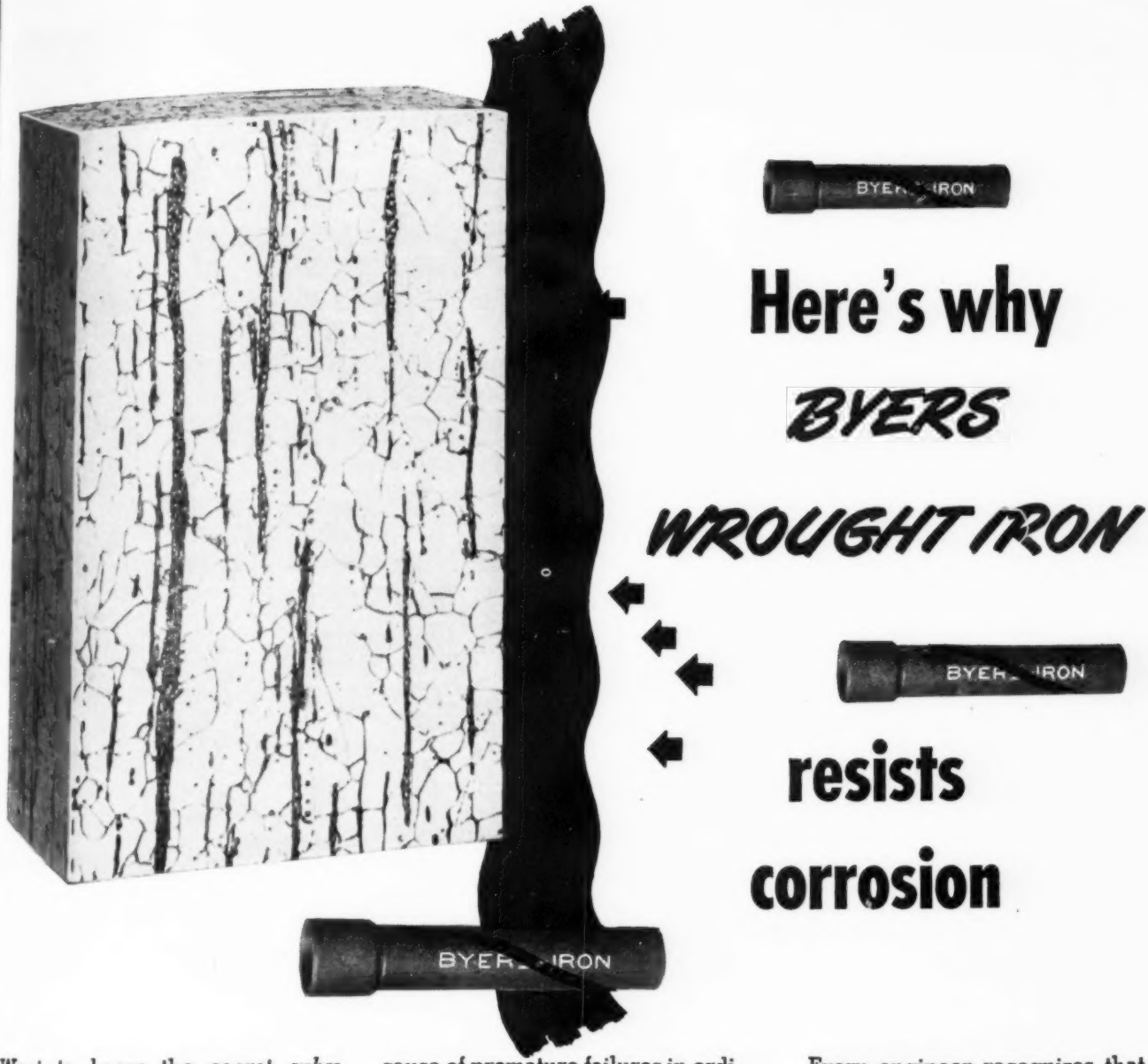
They are streamlined inside where streamlining counts.
Ask what you want of a Gorman-Rupp pump. Give it any kind of a test. Actual performance on the job will convince you.

For details call your nearest distributor.

THE GORMAN-RUPP COMPANY

GORMAN-RUPP PUMPS — UNSURPASSED FOR PUMPING FAST

327 Bowman Street **Mansfield, Ohio**



Here's why BYERS WROUGHT IRON resists corrosion

Want to know the secret *why* Byers Wrought Iron resists corrosion . . . *why* designers use it in the "hot spots" where ordinary materials fail too soon . . . *why* it has helped to stave off repairs and maintenance in hundreds of punishing applications?

You'll find the main answer in the photomicrograph, that shows how a minute piece of wrought iron, not much larger than a grain of sand, looks when it is magnified 100 times. Tiny fibers of "iron glass" (silicate slag) are threaded through the body of high-purity iron. As many as 250,000 of these threads are present in each square inch of section, making up from 1 to 3% by weight of the material.

When corrosion strikes, the fibers serve as a mechanical barrier, to halt and diffuse attack. This discourages the pitting and rapid penetration that are generally the cause of premature failures in ordinary materials. The fibers also help to anchor the initial protective scale, which shields the underlying metal just as a scab protects a wound.

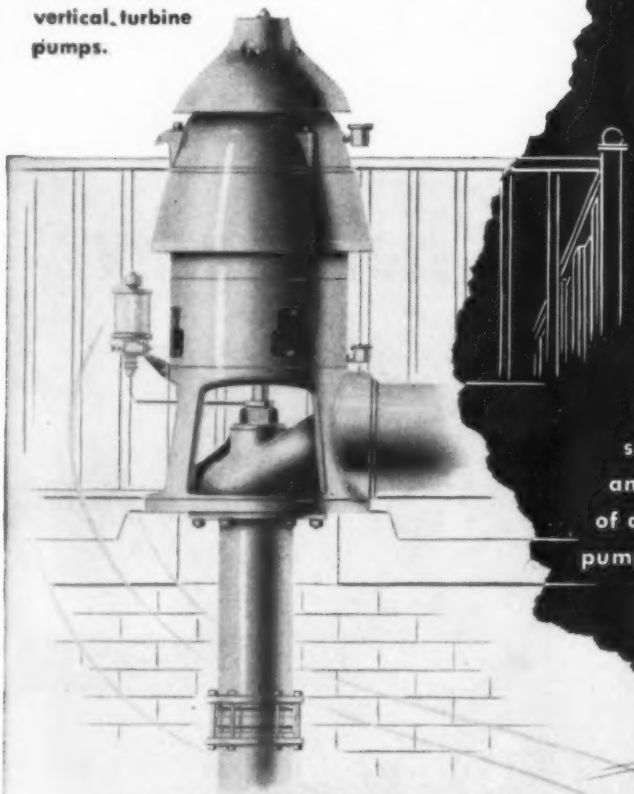
Authorities are agreed that the primary reasons for the unusual corrosion resistance of wrought iron is the combination of high-purity base metal, and glass-like silicate slag. No other metal duplicates the nature and composition of wrought iron . . . *and so no other metal duplicates the resulting service qualities.*

Every engineer recognizes that the uncertainty of future costs and conditions makes it more important than ever to design for maximum durability. Our Engineering Service Department will be glad to help you apply wrought iron in the places where it can serve longer for less. You will find full dimensional information in our General Catalog, sent on request.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Seattle, San Francisco.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

FAIRBANKS-MORSE: Oil-lubricated vertical turbine pumps.



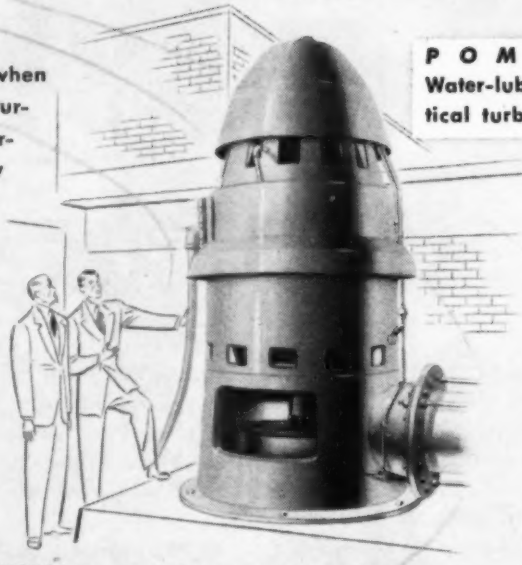
How can you tell a good Pump?

After all, what is the best way to tell a *good* pump? While you can compare efficiency curves, high efficiency in the test-room is no assurance of stamina on the job. Nor can performance data prove that you're getting the pump that's best for your specific liquid-moving work. *The name alone tells this story!*

Who makes it? On a good pump the name plate symbolizes manufacturing facilities, years of research and testing, trained men and intimate knowledge of all pumping requirements that back an ability to pump for you for less, through the years.

THERE'S NO GUESSWORK required when it comes to choosing the best vertical turbine pump for you. For the names of Fairbanks-Morse and Pomona identify every type and size of vertical turbine found in industry today; and these names stand unique in the pump-building world as two of the oldest, most widely respected and "depended upon" pump builders.

POMONA: Water-lubricated vertical turbine pumps.



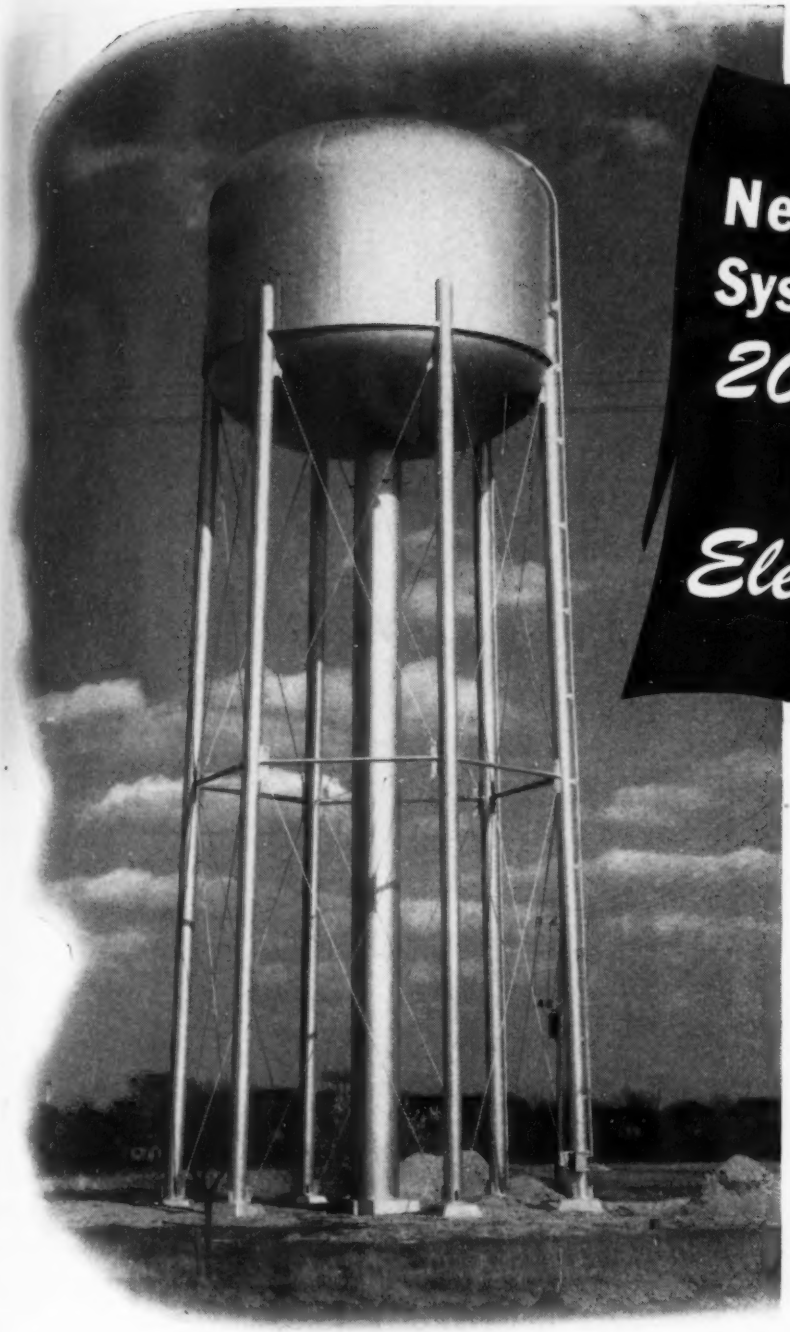
GOOD PUMPS? Yes, and there are many who know these as *the best* of the vertical turbines—thousands and thousands of users who consistently report "maintenance costs nil, power costs extremely low."

REMEMBER THESE NAMES and all that is behind them when faced with a pumping problem. Then see your Pomona dealer or visit your Fairbanks-Morse branch office—the "big store" for all *good* pumps.

FAIRBANKS-MORSE

A name worth remembering

DIESEL LOCOMOTIVES • DIESEL ENGINES • MAGNETOS • GENERATORS • MOTORS • PUMPS
SCALES • STOKERS • RAILROAD MOTOR CARS and STANDPIPES • FARM EQUIPMENT



New Distribution System incorporates 200,000 gal. HORTON Elevated Tank

A NEW water distribution system was recently installed to serve an area in Lansing Township, adjacent to Lansing, Michigan. The Horton elevated water storage tank shown at the left was incorporated in the system to provide gravity water pressure in the mains. By installing an elevated tank of adequate capacity, the engineers responsible for this water system have *gone a long way* towards giving this area satisfactory water service for many years to come.

The water supply, which is taken from three 400-ft. wells located near the center of the distribution system, is pumped into the tank by two 500-gpm and one 600-gpm deep-well turbines. The pressure at the pumping plant is 50 lbs. per sq. in. There are 380 domestic users and 20 industrial users in the distribution system.

The Lansing tank is an *ellipsoidal-bottom and roof structure* of all-welded construction. Horton tanks of this type are available in standard capacities from 40,000 to 500,000 gals. Horton radial-cone tanks are built in standard capacities from 500,000 to 2,000,000 gals.

ENGINEERING DATA

- Source of Water—Three 400-ft. wells
- Area Served—1½ sq. miles
- Miles of Distribution Mains—11
- Diam. of Mains—6 in. to 8 in.
- Number of Fire Hydrants—63
- Number of Meters—400
- Average Daily Consumption—80,000 gals.

CHICAGO BRIDGE & IRON COMPANY

Chicago 4.....2198 McCormick Bldg.
New York 6.....3390-165 Broadway Bldg.
Cleveland 15.....2262 Guildhall Bldg.
Los Angeles 14.....1455 Wm. Fox Bldg.
Birmingham 1.....1586 North 50th St.
Atlanta 3.....2181 Healey Bldg.
Plants in Birmingham, Chicago and Greenville, Pa.

Tulsa 3.....1646 Hunt Bldg.
Houston 1.....5615 Clinton Dr.
Philadelphia 3.....1644-1700 Walnut St. Bldg.
Washington 4.....703 Atlantic Bldg.
San Francisco 11.....1283-22 Battery St. Bldg.
Detroit 26.....1551 Lafayette Bldg.
In Canada: Horton Steel Works, Limited, Fort Erie, Ont.

ADVANTAGES OF PRESTRESSED CONCRETE CYLINDER PIPE • NO. 4

Maximum use of local labor and materials...

● The installation of Prestressed Concrete Cylinder Pipe offers no exception to the Lock Joint Pipe Company's general practice of setting up temporary manufacturing plants near the location of projects—and using a maximum of local labor and local materials.

All necessary equipment for the manufacture of this high head pipe is transported to the temporary plant where the cylinder is fabricated, tested and lined with a substantial thickness of concrete. After a proper curing period, the lined cylinder is tension wrapped with high tensile wire and protected from corrosion by a mortar coating.

Experience on major installations in various parts of the country has proven that Lock Joint Prestressed Concrete Cylinder Pipe offers many important advantages — higher pressures in a greater range of sizes, increased elasticity, minimum weight, excellent performance and maximum water-tightness. You can profit by this experience if you consult us on all your pipeline problems.

A Hazen-Williams Hydraulic Slide Rule will gladly be sent upon request with our compliments.

LOCK JOINT
Reinforced Concrete
PRESSURE PIPE

LOCK JOINT PIPE COMPANY
Established 1905
P. O. BOX 269, EAST ORANGE, NEW JERSEY
Denver, Colo. · Chicago, Ill. · Kenilworth, N. J. · Kansas City, Mo. · Rock Island, Ill.
Joplin, Mo. · Valley Park, Mo. · Cleveland, Ohio · Hartford, Conn. · Navarre, Ohio

SCOPE OF SERVICES *Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply and Distribution Mains in a wide range of diameters as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous lines.*

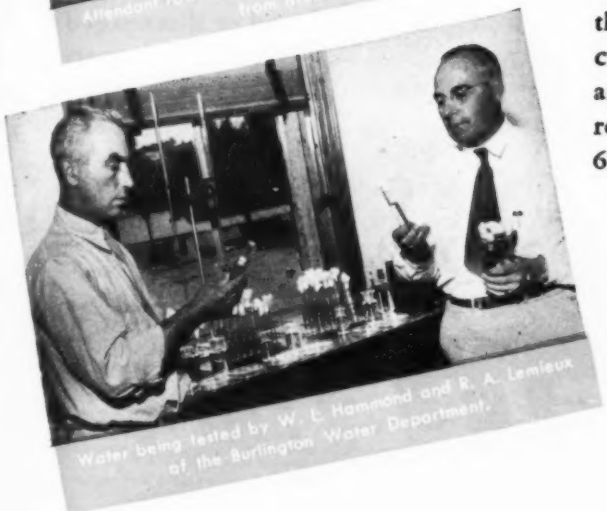
"HTH IS LOW IN COST... EASY TO APPLY, AND HAS SATISFIED US FOR 7 YEARS" says Joseph E. Moore, Supt., Burlington City Water Works, Burlington, Vt.

We're glad that HTH is doing a good job in purifying the millions of gallons of water which are used every day by Burlington and South Burlington, Vermont.

But we're not surprised at Mr. Moore's experience . . . *HTH is popular everywhere!* It pleases water works officials who demand *complete* protection for their communities . . . who want a dependable chlorine carrier for regular, special, or emergency chlorination.

And to show the scope of Sanitation HTH, Mathieson offers water works men a free illustrated copy of "Hypo-Chlorination of Water." In addition to standard sanitation practices, this 80-page booklet deals with the use of HTH in emergencies . . . in the treatment of filters . . . in the control of algae and in the sterilization of new mains. Send for your copy—it's ready for you! THE MATHIESON ALKALI WORKS (Inc.), 60 East 42nd St., New York 17, N. Y.

Attendant rowing boat while HTH solution flows from drum.


Water being tested by W. E. Hammond and R. A. Lemieux of the Burlington Water Department.

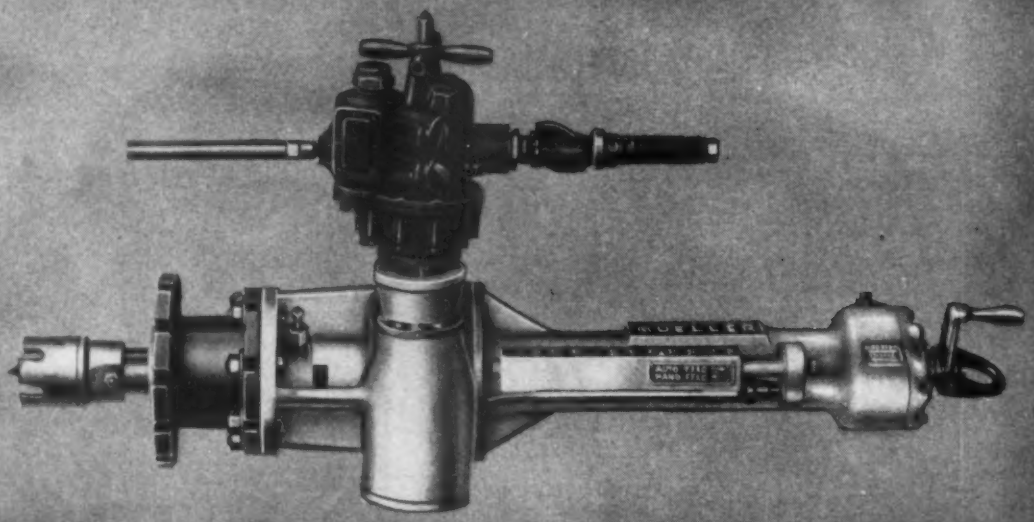
SANITATION HTH is available in cases of nine 5-lb. cans and in 100-lb. drums.

Mathieson
SANITATION HTH

Sanitation HTH . . . PH-Plus (Fused Alkali) . . . Chlorine Dioxide . . . Caustic Soda . . . Soda Ash . . . Bicarbonate of Soda . . . Ammonia, Anhydrous & Aqua Dry Ice . . . Carbonic Gas . . . Synthetic Salt Cake Sodium Chlorite Products . . . Sodium Methylate

EXTRA POWER

FOR THOSE TOUGH CUTS



MUELLER "C-1" POWER OPERATED DRILLING MACHINE

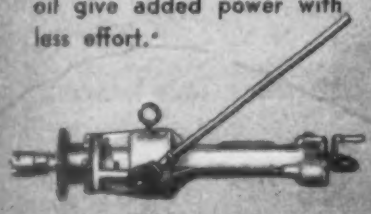
FOR USE WITH TAPPING SLEEVES AND VALVES, TO MAKE CUTS UNDER PRESSURE

MAXIMUM STRENGTH
All parts made of the finest materials, accurately machined and assembled.

EXTREMELY COMPACT
Telescopic arrangement of working parts permits operations in close quarters.

VERSATILE
Drilling capacity from 2 inches to 12 inches in any size main and in any position. Will handle any pressure up to 1000 lbs.

EASY OPERATION
Large, precision cut worm or bevel gears encased in oil give added power with less effort.



MUELLER MODEL "C-C" HAND OPERATED DRILLING MACHINE

Mueller Drilling Machines offer the time proven method for making cuts in a line under pressure. The "C-1" Machine is very popular with companies having occasion to make large cuts as it is air operated and cuts rapidly and positively into any size main. The special air motor drives the cutter at the correct speed, the feed is automatic and an indicator shows the position of the cutter at all times.

The "C-C" Machine has the basic constructional advantages of the "C-1" Machine except that it is hand operated and may be used where air is not available. It is provided with automatic feed which may be engaged or disengaged in an instant by an exposed button. Large bevel gears multiply the power of the operator, making large cuts a very easy operation. The handle operates parallel with the Machine, eliminating extra digging for operating room. Other Mueller Machines are available that will drill, tap and insert corporation stops into mains under pressure. Write for full information.

MUELLER CO.

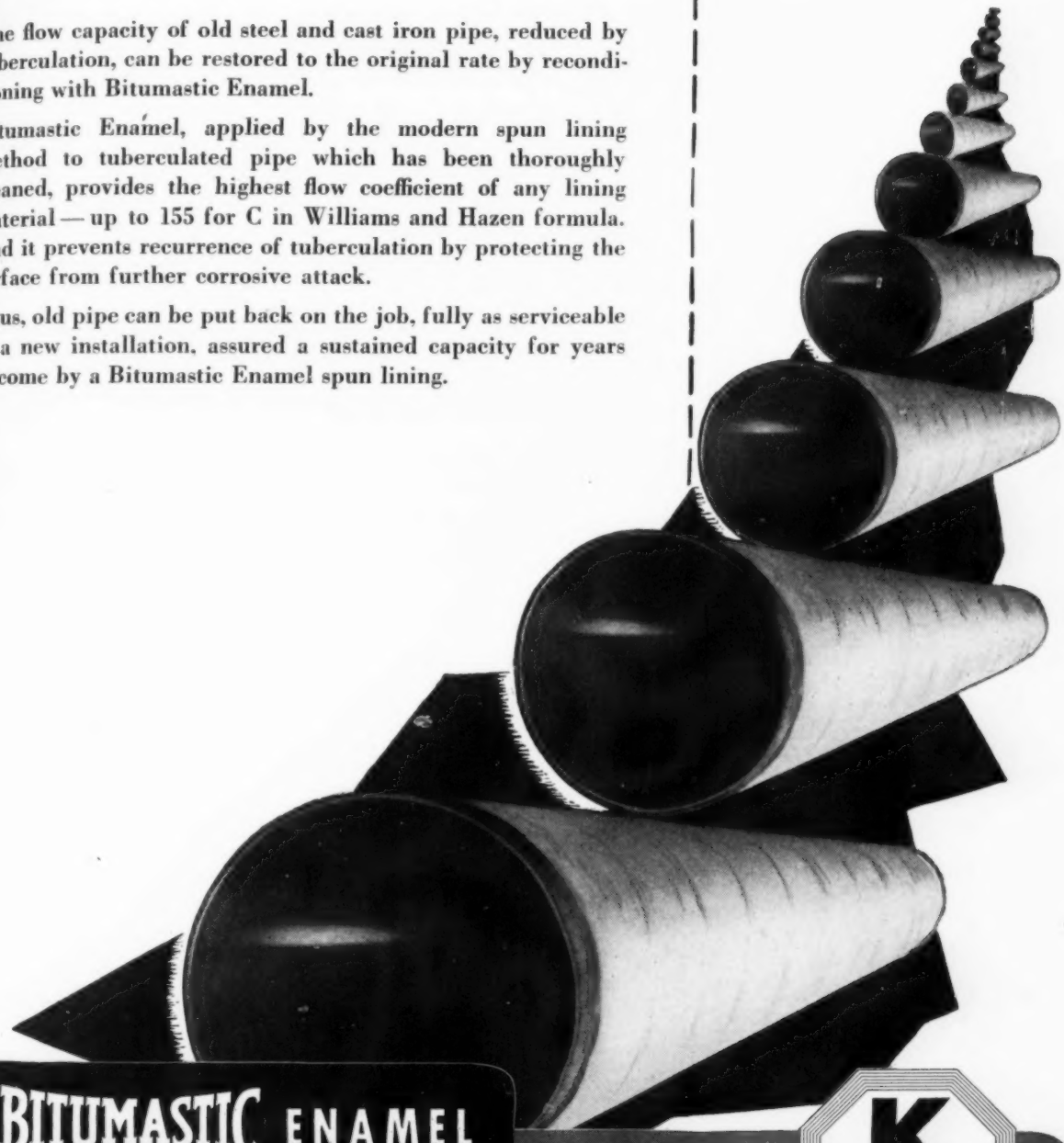
DECATUR, ILL. SARNIA, ONT., CAN. CHATTANOOGA, TENN. LOS ANGELES, CAL.

Keep them flowing . . . with BITUMASTIC ENAMEL!

The flow capacity of old steel and cast iron pipe, reduced by tuberculation, can be restored to the original rate by reconditioning with Bitumastic Enamel.

Bitumastic Enamel, applied by the modern spun lining method to tuberculated pipe which has been thoroughly cleaned, provides the highest flow coefficient of any lining material — up to 155 for C in Williams and Hazen formula. And it prevents recurrence of tuberculation by protecting the surface from further corrosive attack.

Thus, old pipe can be put back on the job, fully as serviceable as a new installation, assured a sustained capacity for years to come by a Bitumastic Enamel spun lining.

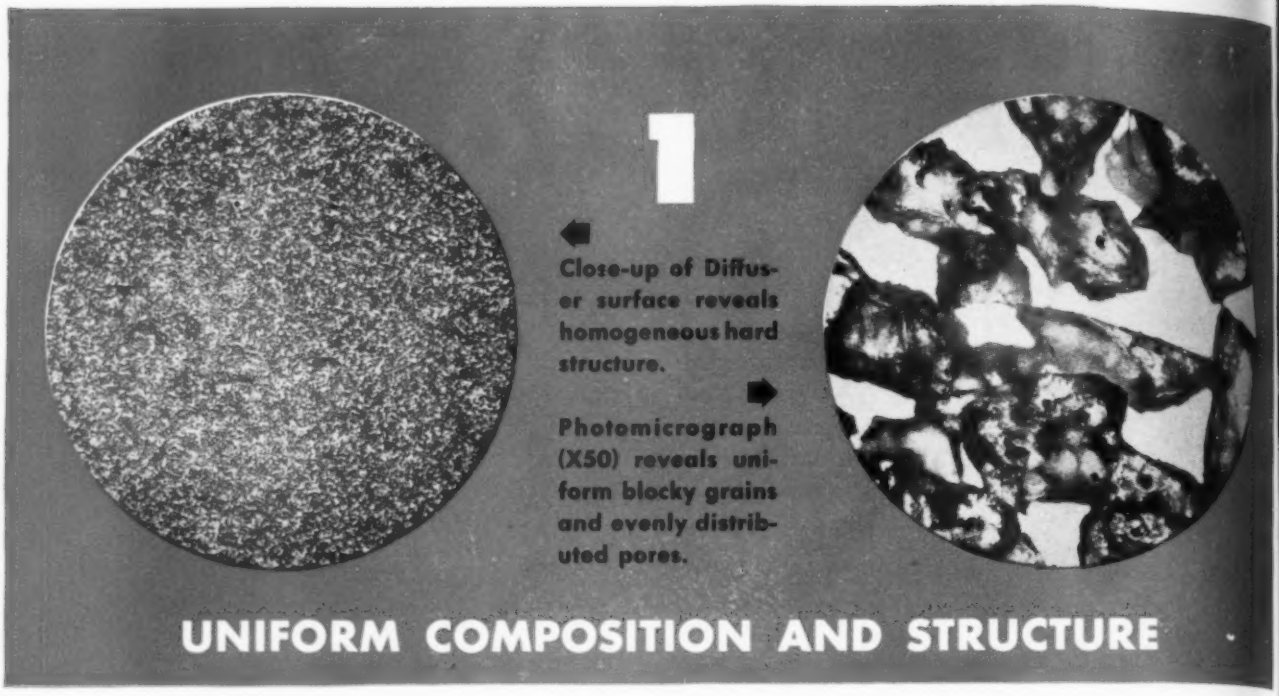


BITUMASTIC ENAMEL
REG. U. S. PAT. OFF.

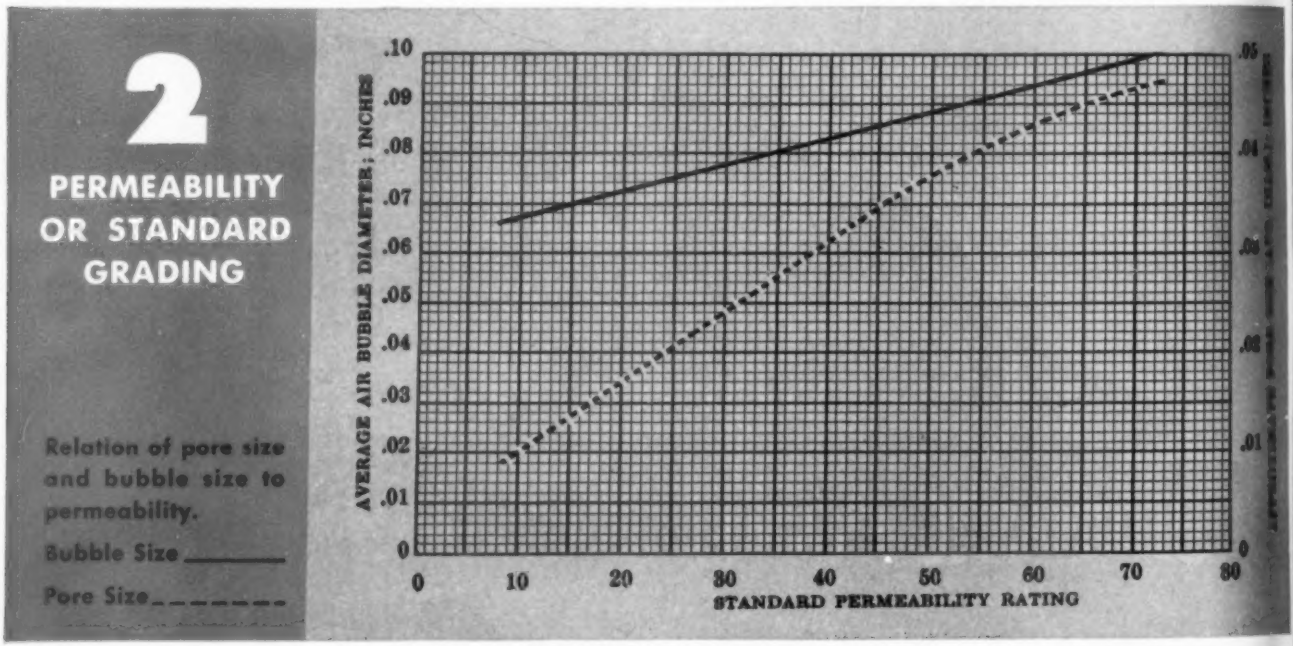
Wailes Dove-Hermiston Corporation
A SUBSIDIARY OF KOPPERS COMPANY, INC.
WESTFIELD, NEW JERSEY
NEW YORK 4 · PHILADELPHIA 8 · CLEVELAND 14 · CHICAGO 3
HOUSTON 2 · TULSA 3 · MIAMI 36 · SAN FRANCISCO 10 · LOS ANGELES 1

K KOPPERS

Here's what you want in DIFFUSER MEDIA


1
Close-up of Diffuser surface reveals homogeneous hard structure.
Photomicrograph (X50) reveals uniform blocky grains and evenly distributed pores.
UNIFORM COMPOSITION AND STRUCTURE

Made from selected sizes and shapes of grain which is bonded, molded and vitrified, ALOXITE electrically fused aluminum oxide Diffuser Media present a hard, homogeneous structure. Under the microscope uniform, blocky, angular-edged grain and evenly distributed pores are revealed. The unique surface structure speeds release of small air bubbles because their surface tension is less. A high ratio of pores to total volume minimizes clogging. Low resistance to air passage is achieved through connected pores between smooth bond-covered grains. This stable and durable structure of ALOXITE Diffusers resists all ordinary acids and corrosive agents encountered in sewage and water treatment. Temperature changes and physical or mechanical stresses found in such applications do not bother these Diffusers.

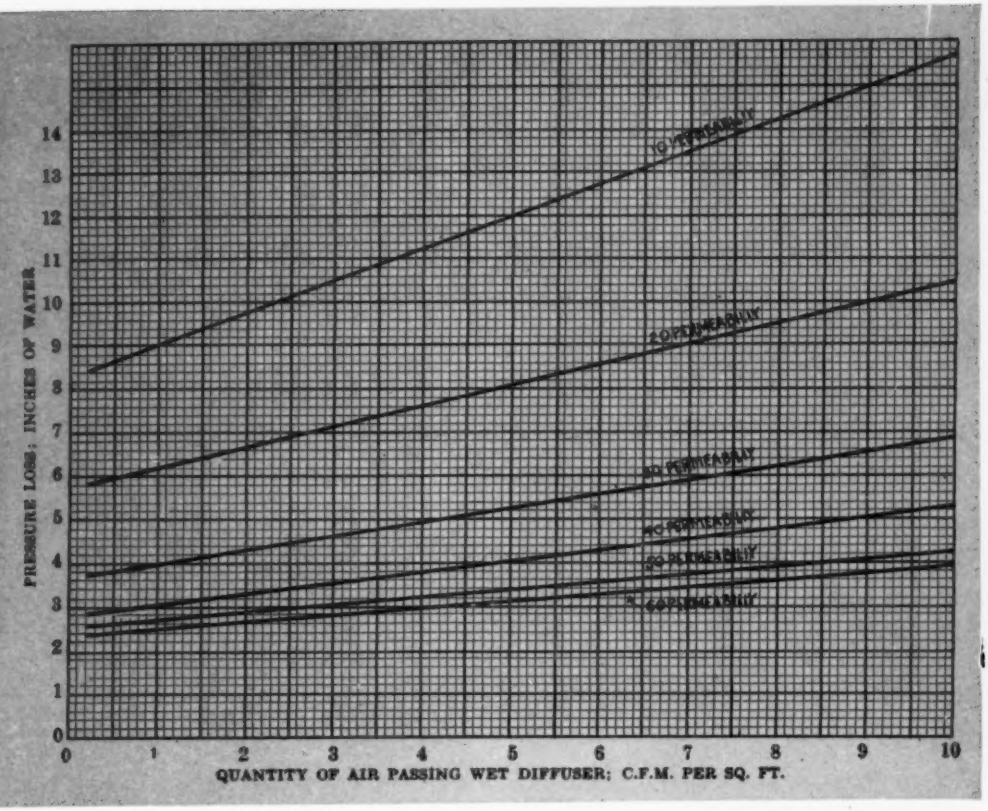


Efficient operation of any diffuser media installation depends on utilizing many individual units of similar grain size and pore structure. The standard grading of diffusers is called permeability. Permeability is most directly related to the size of pores provided by the size of grain used. Because diffusion of small bubbles means more efficient aeration, porous diffusers provide three times the efficiency of perforated pipe. ALOXITE Porous Media diffuse the smallest possible bubbles at any given permeability rating.

Permeability tests pioneered by The Carborundum Company assure economy of operation at low cost by insuring uniform diffusion throughout the tank.

3 PRESSURE LOSS

Low pressure loss through submerged Diffusers of various permeability ratings.



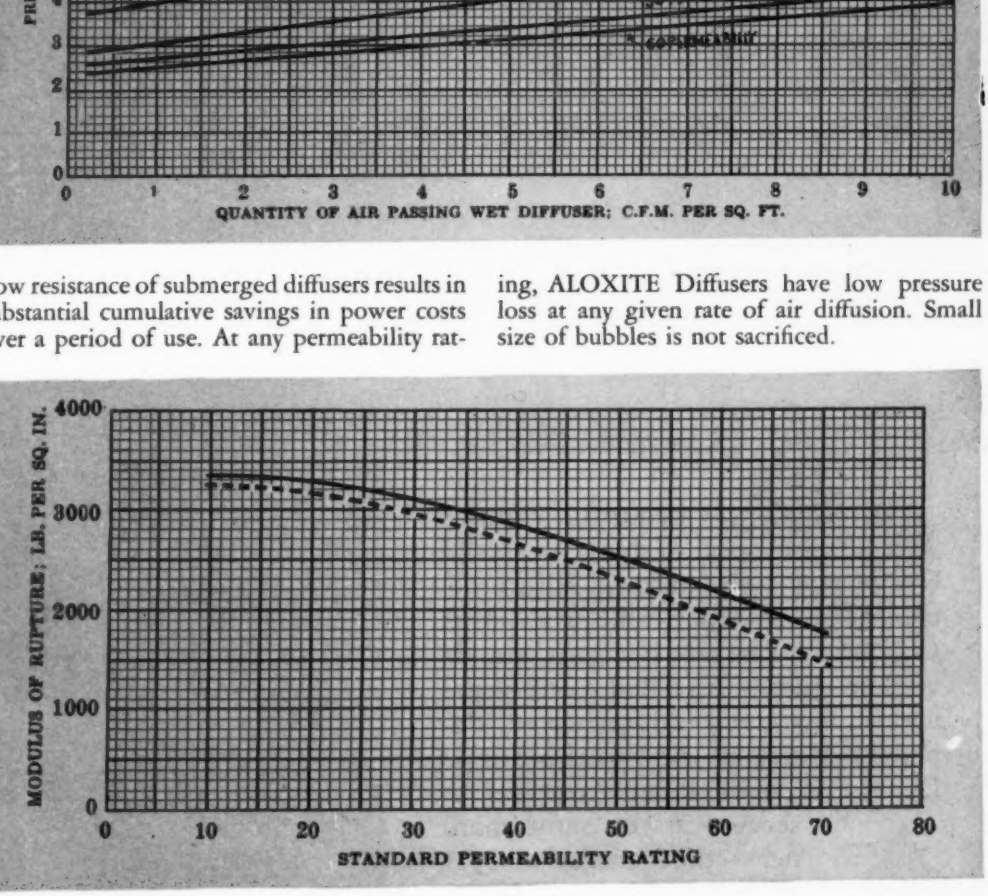
Low resistance of submerged diffusers results in substantial cumulative savings in power costs over a period of use. At any permeability rating, ALOXITE Diffusers have low pressure loss at any given rate of air diffusion. Small size of bubbles is not sacrificed.

4 STRENGTH FOR SAFETY

Relation of strength to permeability.

Dry_____

Saturated_ _ _



Uniformly supported ALOXITE Diffuser Plates support a 20 ft. column of sewage or water with a safety factor of 5 or more. Because most stresses are incurred during installation or accidentally, a test load of 1,000 lbs. is applied to the center line of each plate while it is supported only at each parallel edge. The high modulus of rupture is shown here.

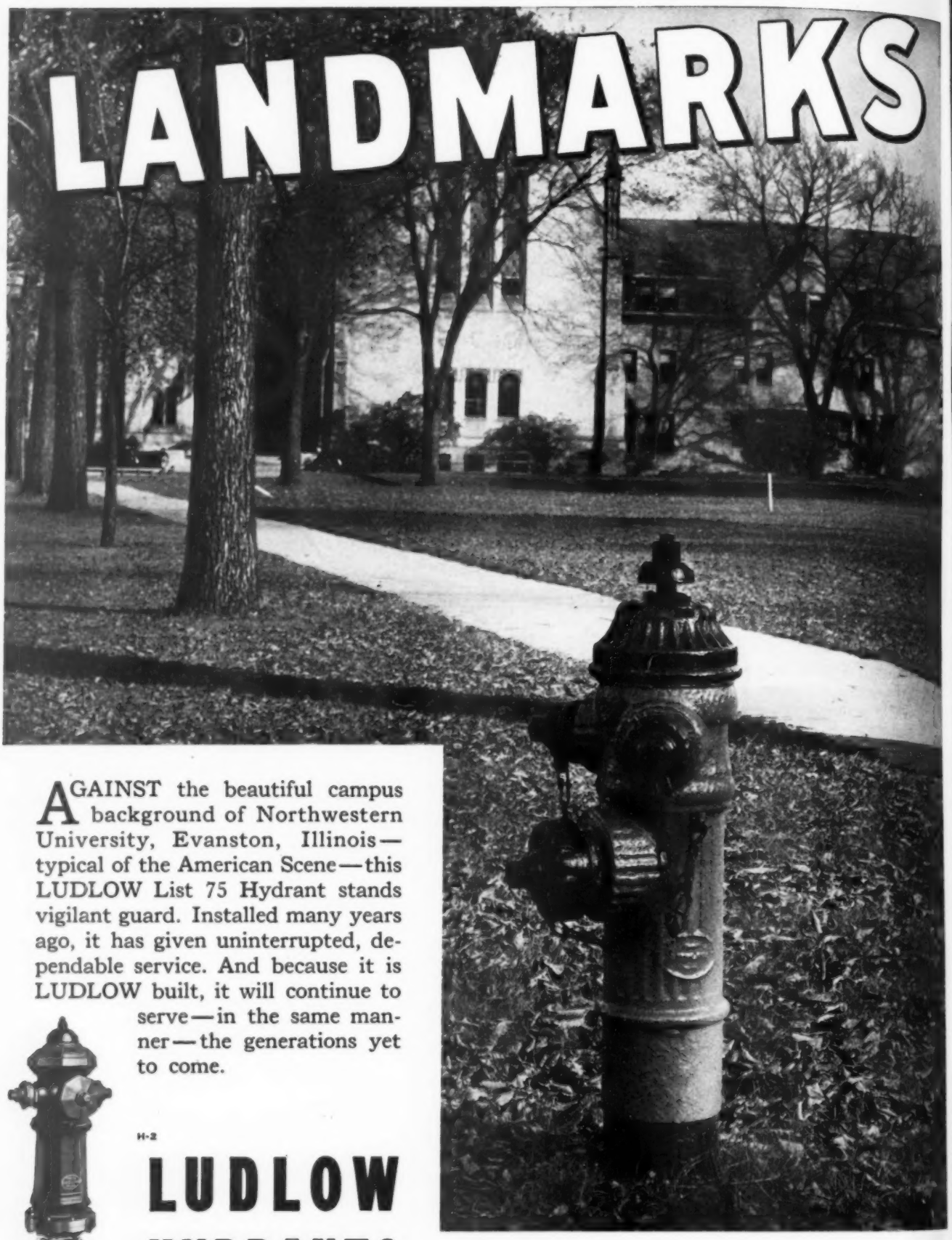
For experienced advice, data or assistance, write Dept. O-116, The Carborundum Company, Refractories Division, Perth Amboy, New Jersey.

DIFFUSER MEDIA

BY CARBORUNDUM

TRADE MARK

"Carborundum" and "Aloxite" are registered trademarks which indicate manufacture by The Carborundum Company



AGAINST the beautiful campus background of Northwestern University, Evanston, Illinois—typical of the American Scene—this LUDLOW List 75 Hydrant stands vigilant guard. Installed many years ago, it has given uninterrupted, dependable service. And because it is LUDLOW built, it will continue to serve—in the same manner—the generations yet to come.

H-2

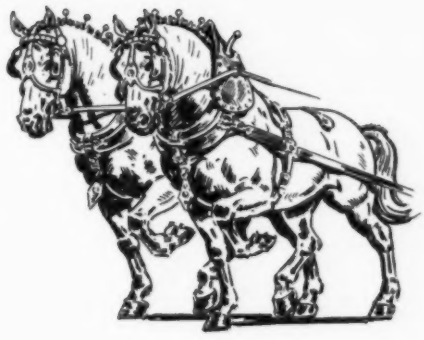
LUDLOW HYDRANTS & VALVES

SINCE 1866

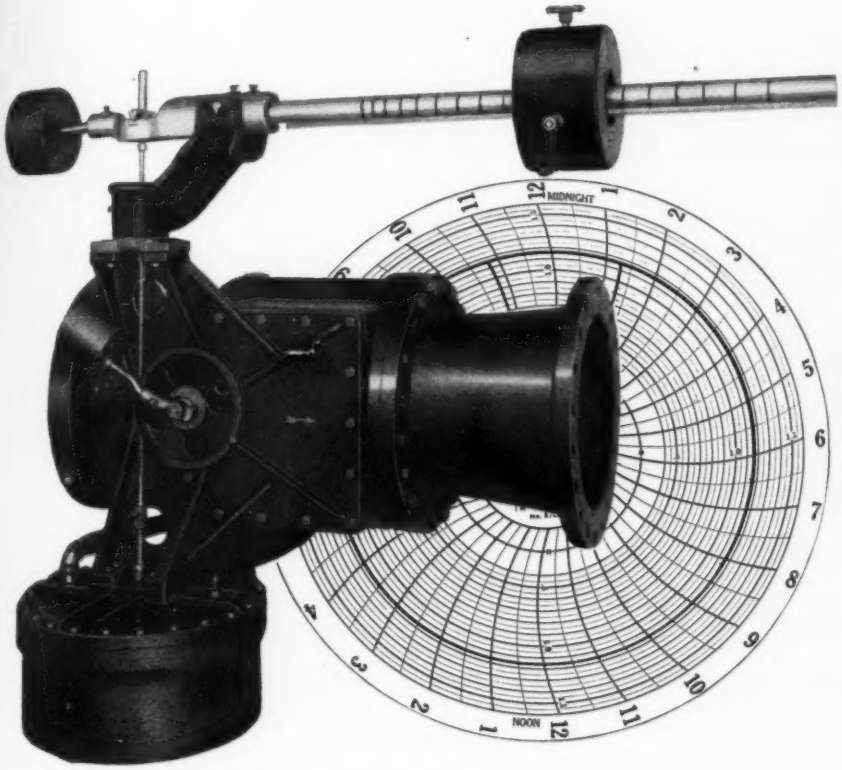
Quick water . . . proper drainage . . . no flooding . . . easy inspection and service . . . these are the features you need and want. You'll find them all built into LUDLOW Hydrants.

Write for full particulars.

THE LUDLOW VALVE MFG. CO., INC., TROY, N. Y.



A Matched Pair for Matchless Performance



BUILDERS CONTROLLERS & GAUGES

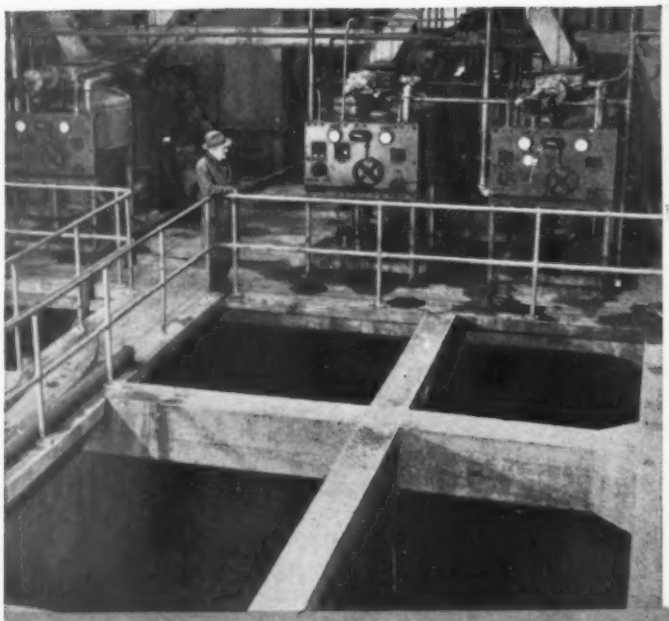
FOR PRECISE CONTROL specify equipment made to work together as a team. Builders Controllers and Gauges are a perfect combination for the modern waterworks plant, large or small. Builders Controllers compensate for filter head variations so closely that the rate of flow, as recorded on the chart, forms a perfect circle as shown above. The balanced control valve responds to the slightest change in flow. Builders design avoids "hunting" by providing a valve path completely free of air pockets. Builders Model RCE Controller has the greatest accuracy, the smallest maintenance requirement and the least tendency to "hunt" of any waterworks controller available today. For Bulletin 321A, address Builders-Providence, Inc. (Division of Builders Iron Foundry), 10 Codding Street, Providence 1, R. I.

OTHER BUILDERS PRODUCTS

Venturi, Propeloflo and Orifice Meters • Type M and Flo-Watch Instruments • Master Controllers • Kennison Nozzles • Chronoflo Telemeters • Conveyor Scales

FOR PRECISE METERING Builders Gauges furnish the information vital to efficient filter operation . . . rate of flow, loss of head, water level and sand expansion. Each instrument is uniform in appearance, available with or without floor stand and has a simple, durable mechanism . . . approved by leading waterworks engineers. Graduations on indicators and charts are uniformly spaced over the entire measuring range. Bulletin 329A on request.

BUILDERS BUILDERS Instruments **PROVIDENCE**

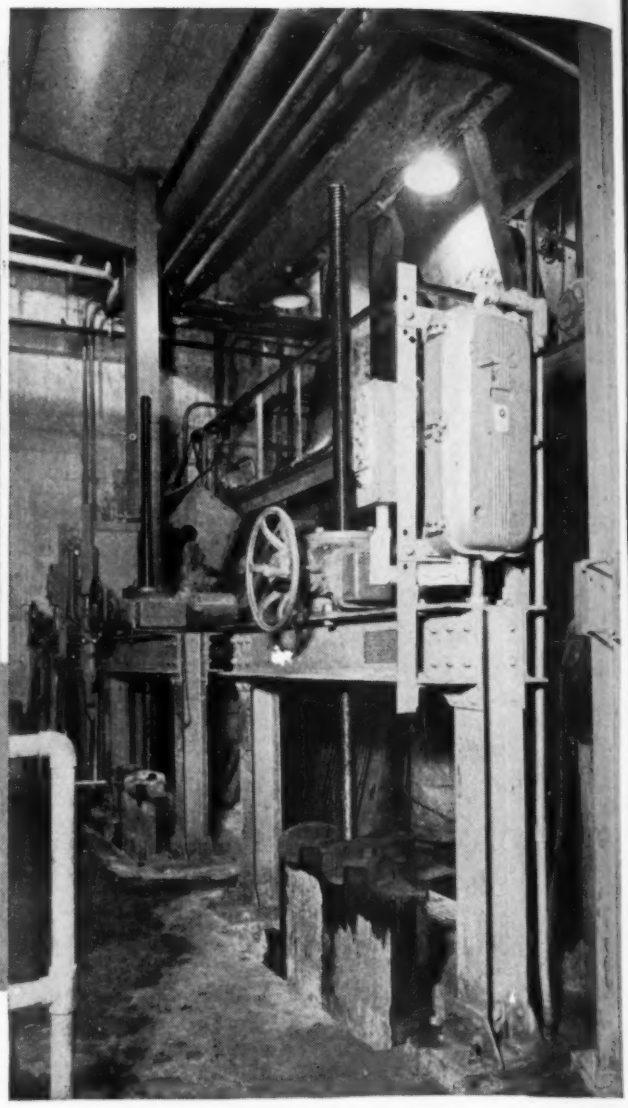


Where Everdur Serves in New Jamaica Plant...

In 5 hydraulic sluice gates: Bolts, facing strips and other mounting parts. Also copper-silicon alloy 4¼ inch diameter operating stem.

In two inclined 20-foot diameter revolving disc screens: Slotted Everdur plates for cone and disc.

In four grit ejectors: Everdur for gate slides and cylinders, piston rods, valve stems, bolts and nuts.



Everdur provides long life for Jamaica's Grit Ejectors

FOUR GRIT EJECTORS of 40 cu. ft. capacity each, with 12-inch inlet and 8-inch discharge slide gates, are in continuous service at the Jamaica Sewage Treatment Plant of the City of New York.

All gate slides and cylinders, piston rods, valve stems, operating gear, bolts and nuts are of Everdur*. These copper-silicon alloys of The American Brass Company were selected by Krajewski-Pesant Mfg. Corporation, designers and fabricators of the equipment, because of the high strength, workability and weldability of these alloys, and their high resistance to many types of corrosive gases and liquids.

For detailed information on Everdur Copper-Silicon Alloys in sewage and water works service, write for Publications E-11 and E-5.

*Reg. U. S. Pat. Off. 48219

ANACONDA

Everdur

COPPER-SILICON ALLOYS

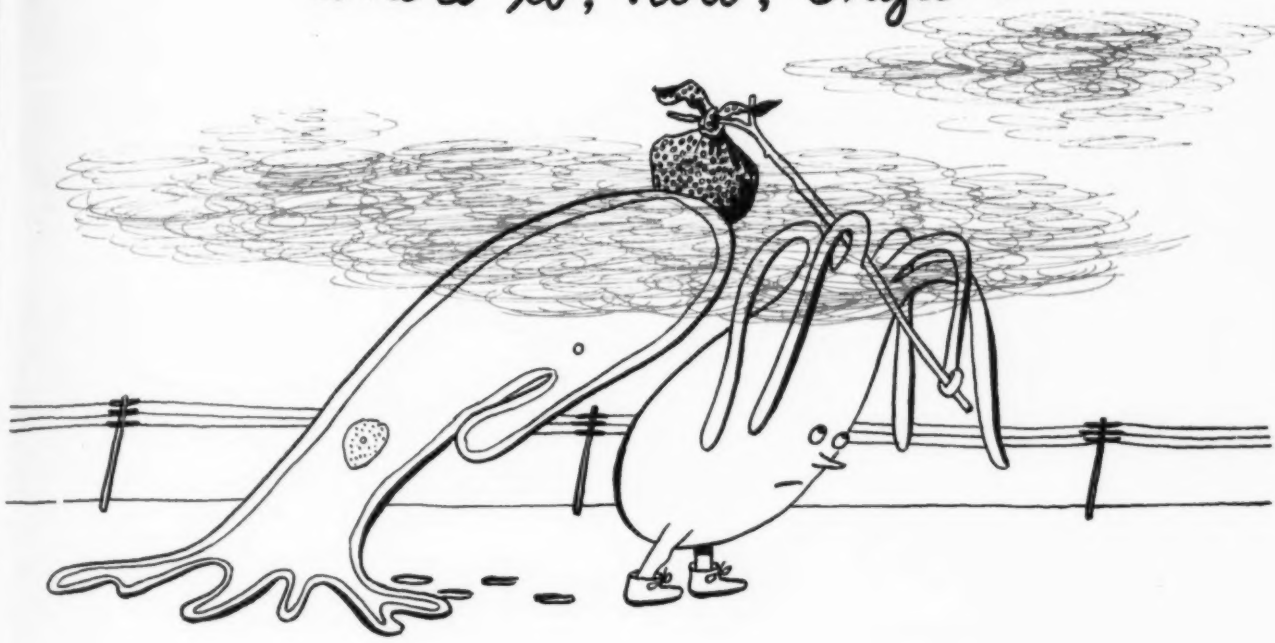
THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

"where to, now, Orgie?



they're using **PITTCHLOR*** almost every place"

Packed in readily identified red, white and blue 5 lb. resealable cans (9 per case), 3-¾ lb. cans (12 per case) and 100 lb. drums.

It's a sad day for chlorine-susceptible microorganisms when Pittchlor makes its appearance—for its **70%** available chlorine spells sure death for them.

Easy to use, Pittchlor is a high-test calcium hypochlorite which is highly effective in the chlorination of water . . . in the treatment of sewage . . . and for many other disinfection, deodorant and general sanitation applications where such public protection is essential.

Stocked by leading jobbers—write for literature.

* Trade-mark Registered U. S. Patent Office

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PITTSBURGH PLATE GLASS COMPANY

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Soda Ash · Caustic Soda · Liquid Chlorine · Sodium Bicarbonate · Pittchlor (*Calcium Hypochlorite*) · Silene EF (*Hydrated Calcium Silicate*) · Calcium Chloride · Soda Briquettes (*Iron Desulphurizer*) · Modified Sodas · Caustic Ash · Phosflake (*Bottle Washer*) · Calcene T (*Precipitated Calcium Carbonate*)

MR. SANITARY ENGINEER!

YOU CAN'T GO WRONG WHEN YOU SPECIFY "VAREC" *approved* FITTINGS

THE PACE SETTER SINCE 1928

VAPOR RECOVERY SYSTEMS CO.
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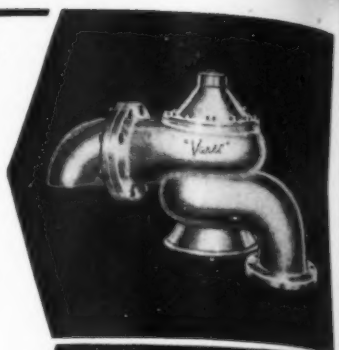
(All Codes)

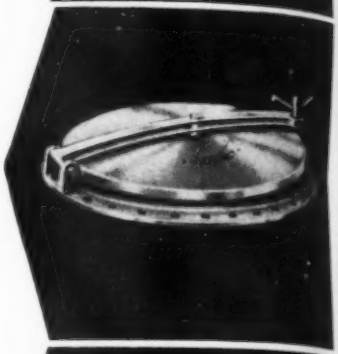
"VAREC" ENGINEERING and TESTING LABORATORY is at your service to collaborate on problems regarding tank fittings.

Send for "VAREC" Catalog S-3 illustrating all "VAREC" approved equipment.



"VAREC" approved PRESSURE RELIEF and VACUUM BREAKER VALVE is usually installed on gas holder domes where compressor system is used for high pressure gas storage. Various material combinations and activated by dead-weight, spring-loaded and lever mechanisms or combinations thereof.

◆



"VAREC" approved MANHOLE COVER or Entrance Hatch Cover afford quick and easy access into digester and gas holder domes or any reservoir where entrance may be required. Nonsparking and foolproof.

◆

"VAREC" approved SAMPLING HATCH or Handhole cover is installed on sampling pipes on digester domes. Self-closing, nonsparking gastight, and noncorrosive, it meets all insurance requirements. Available in screwed or flanged connections.

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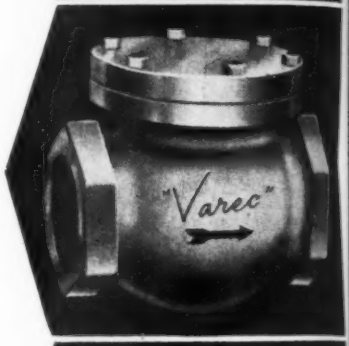

"VAREC" approved BACK PRESSURE CHECK VALVE is installed in water, oil, or other lines carrying viscous liquids. Nonchattering, nonpulsating type, a most satisfactory check down stream of meter installations. Available in screwed or flanged connections.

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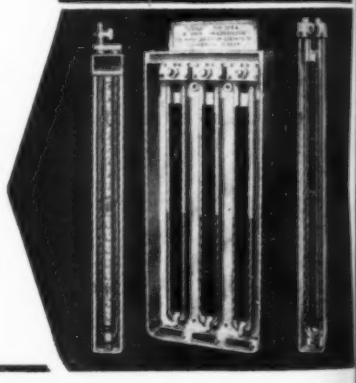
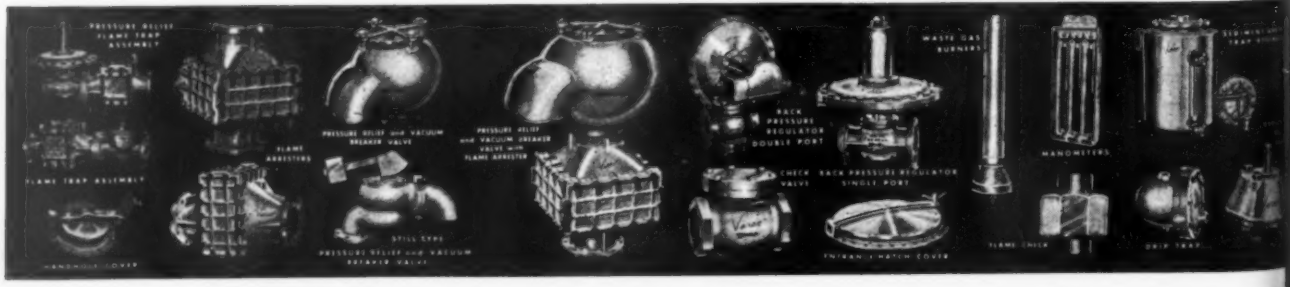
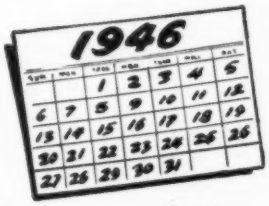


"VAREC" approved MANOMETERS — "U" tube manometers insure positive accurate pressure reading, especially when indicating low pressures. For use with water or mercury. "Varec" manometers are equipped with adjustable scale, graduated in inches and tenths to compensate for any possible change in fluid volume.



Only two cents *per capita* *per year*  • • •

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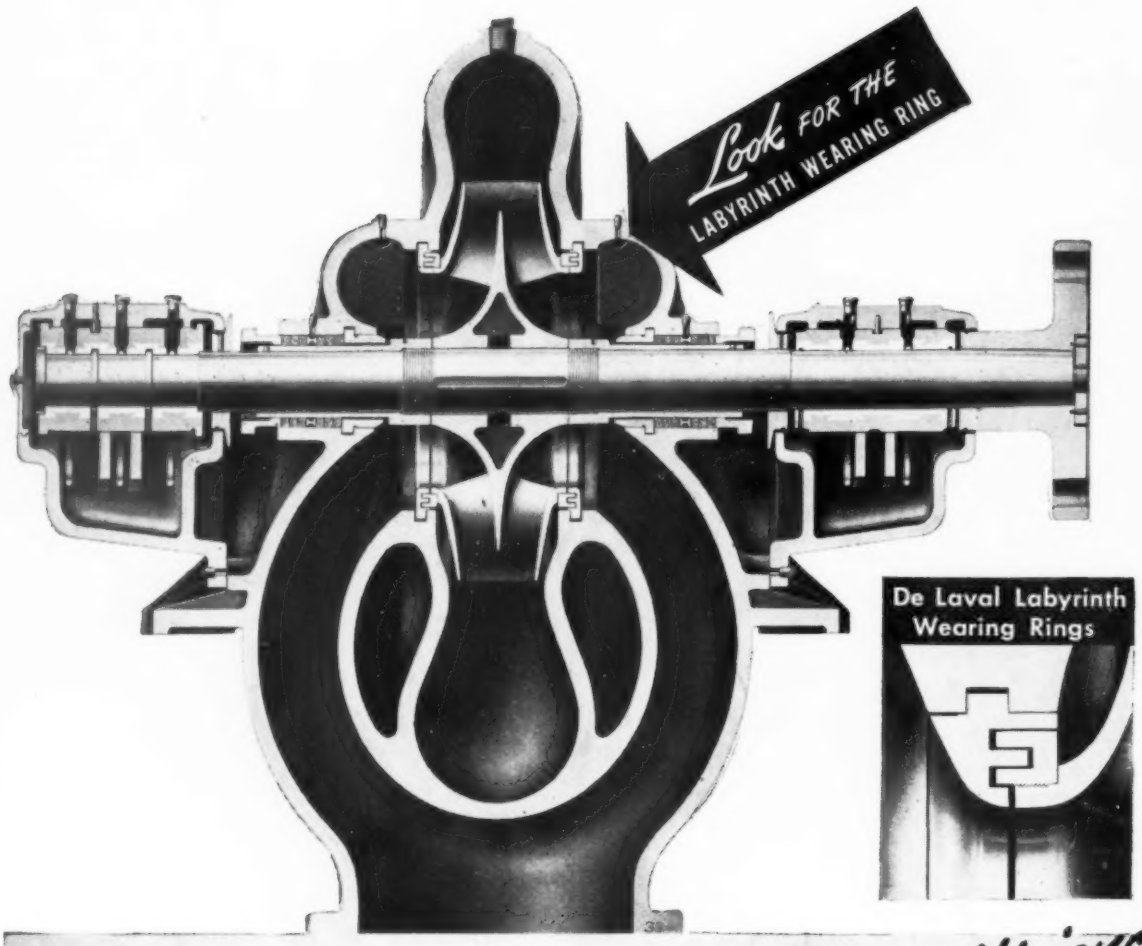

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De Laval Labyrinth Wearing Rings minimize leakage from discharge back to suction. The sealing action of these rings is accomplished by the use of large clearance, tortuous labyrinth passages and does not depend upon close mechanical clearances, such as required for plain flat rings. Because of the larger clearances and reduced flow, the effectiveness of the De Laval labyrinth ring is but little diminished by wear, resulting in sustained efficiency for long periods. When selecting pumps for lowest ultimate cost, look for the De Laval Labyrinth Wearing Ring.

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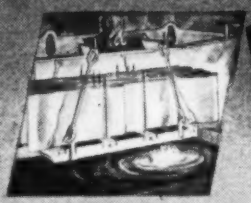
RIMMING STEEL: Used in pouring billets to insure a smooth rolled sheet

WOOD PRESERVATIVE: To prevent insect attack on structural and other materials



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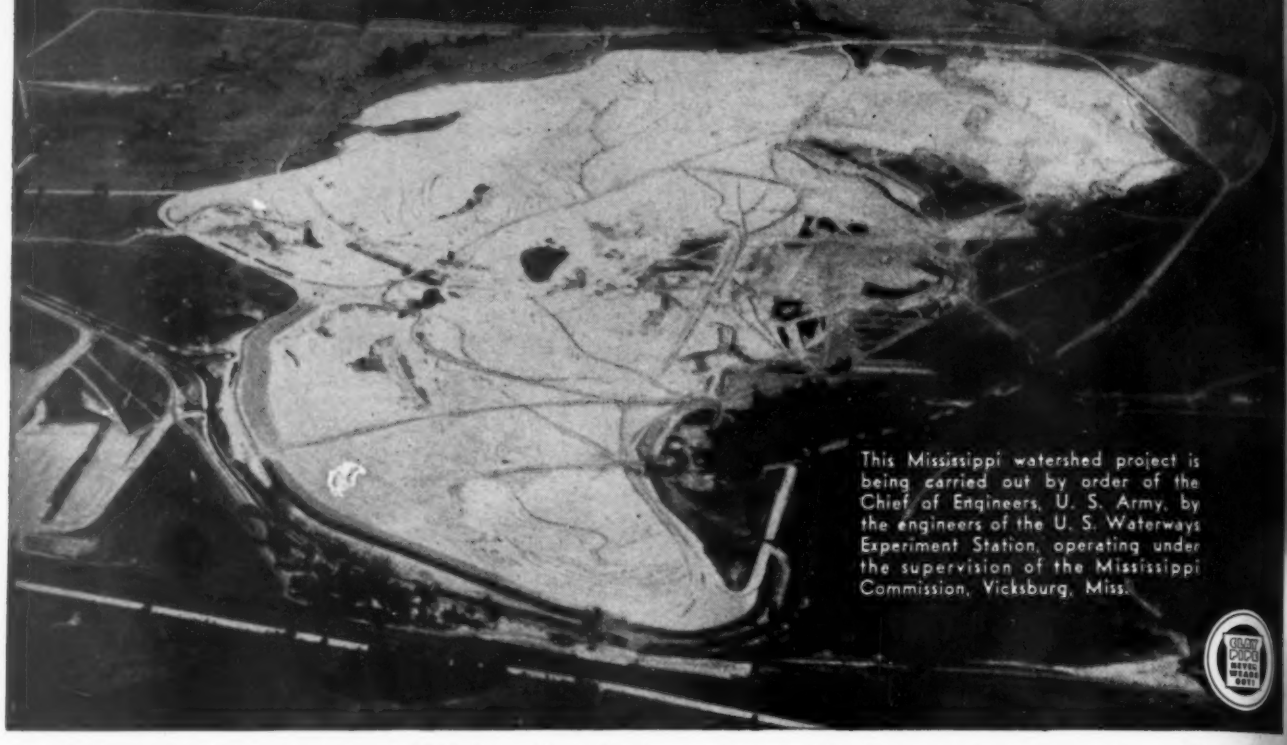
CLAY PIPE DRAINS 200-ACRE MODEL OF MISSISSIPPI WATERSHED



This Mississippi watershed project is being carried out by order of the Chief of Engineers, U. S. Army, by the engineers of the U. S. Waterways Experiment Station, operating under the supervision of the Mississippi Commission, Vicksburg, Miss.

U. S. Army engineers are using 54,000 feet of Vitrified Clay Pipe in constructing the large drainage system of the elaborate 200-acre scale model of the Mississippi Valley shown above. This model is being built to study flood control methods in the 1,244,000 square miles of the Mississippi watershed. Engineers found drainage absolutely vital to this huge scale model for two reasons: (1) the necessity for carrying off torrential rainfalls, (2) for removing water pumped into the replica to simulate flood conditions. The entire model, representing 41 per cent of the total area of the United States, will require 3 to 5 years to complete. Actual operation will be initiated as soon as a sizable section of the model is ready.

HERE IS AN EXAMPLE OF EXPERT CONSTRUCTION!

Note the narrow trenching up to the top level of the pipe . . . die-straight, accurate alignment . . . control of trench width . . . carefully-made joints. Here's a job that has been carefully engineered and carefully installed for the very best results.

ON ANY PROJECT, combine engineering "know how" with Clay Pipe, and you have an unbeatable combination for long, trouble-free service! Clay, nature's raw material, is shaped under tremendous pressure and vitrified at fusing temperatures to produce the tough, hard pipe that never wears out. Clay Pipe is impervious to acids, corrosion, crumbling and rust. It does not require periodic or frequent replacement. *When you use clay, it's down to stay!*

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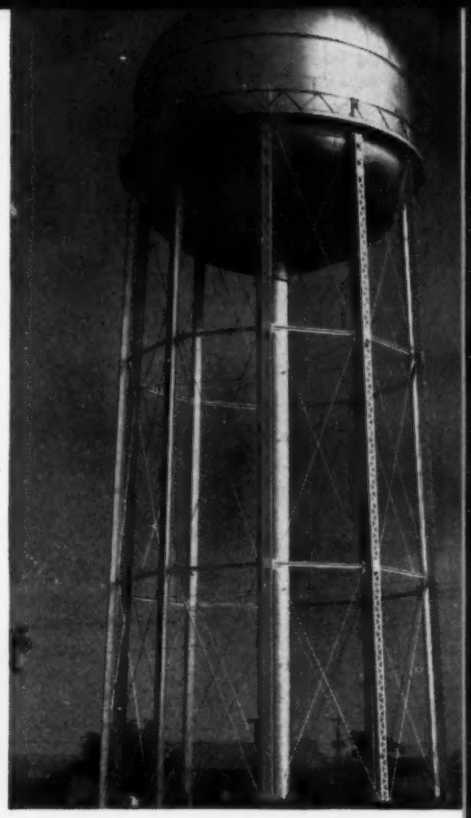
CABIN JOHN, Md.—500,000 gallon toroidal bottom tank, 60' diameter, on 100' tubular column tower.

ARLINGTON COUNTY, Va.—500,000 gallon toroidal bottom tank, 60' diameter, on 81' tubular column tower.



MISSION, Tex.—500,000 gallon double-ellipsoidal tank, 50' diameter, on 100' tower.

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ELEVATED STEEL TANKS by *Pittsburgh·Des Moines*

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Rugged pipe for rugged terrain! In our laboratories, and throughout its production, we see to it that U. S. Cast Iron Pipe is "long" on strength factors—beam strength, bursting strength, and high resistance to external loads. Given the good laying practise that rough country and heavy fills call for, you can count on U. S. Cast Iron Pipe living up to its reputation for long and reliable service.

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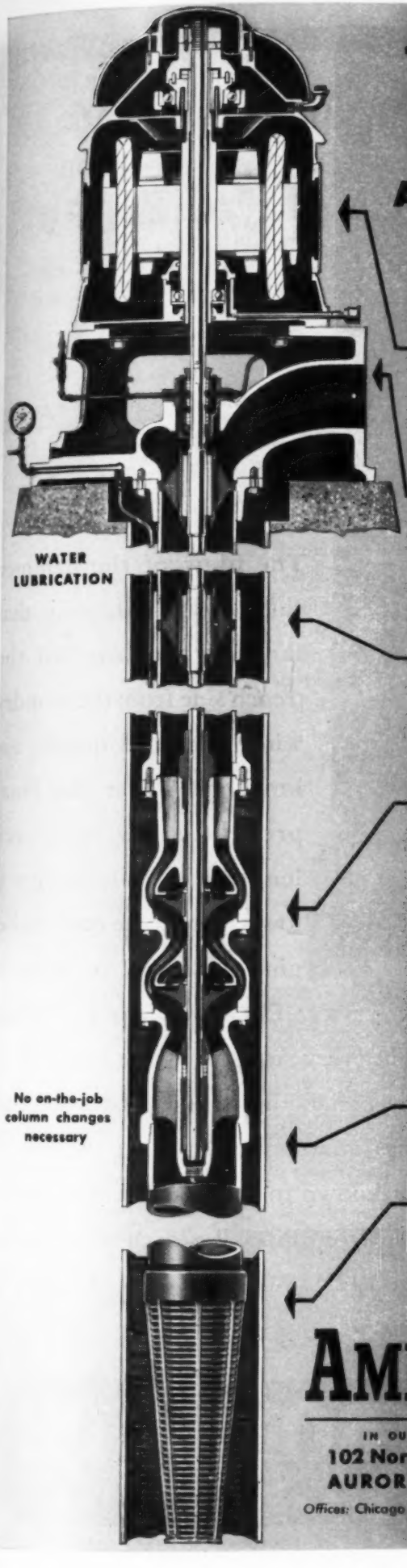
AMERICAN DEEP WELL TURBINES

are designed for long efficient service



MOTOR—Weatherproof, enclosed type keeps moisture and dirt out of working parts of motor. Hollow shaft design simplifies installation and facilitates adjustment of pump rotating element at top of motor. These turbines are also available for engine or dual drive with right angle gear unit.

DISCHARGE HEAD—Deep bronze packing box, grease sealed, with bronze seal rings and gland, and connections for vent to atmosphere and prelubrication line . . . designed for high pressure with minimum leakage. The top line shaft bearing, actually an *additional* head shaft bearing, is located *at the top* of the column, thereby eliminating whipping through packing box.

COLUMN—Full weight steel column pipe in standard 10′ lengths. Straight thread couplings for sizes up to 7″. Flanged construction for sizes larger than 7″. Bronze bearing housings and guides at each column pipe joint. Water lubricated, fluted rubber bearings at non-corrosive wearing surfaces of shaft.

BOWL ASSEMBLY—Flanged upper bearing, provided with two bearings, cast integral, each bearing having a renewable bronze bushing. Flanged bowls, with uniform and smooth water passages and renewable bronze wearing rings. Shaft steady bearings cast integral, provided with renewable bronze bushings. Flanged lower bearing, provided with renewable bronze bearing bushing and wearing ring, properly lubricated and sealed before shipment, requiring no further attention in the field.

Bronze enclosed impellers have uniform, hand finished water passages. Given a final machining operation after assembly on shaft to assure correct running clearances between rotating and stationary elements, and rotative balance. Stainless steel pump shaft with positive stainless steel locking device to firmly position each impeller to shaft.

SUCTION PIPE—Full weight steel pipe which screws on to lower bearing. One ten foot length generally recommended.

STRAINER—Sturdy, galvanized, taper-type, with threaded coupling for suction pipe. Generally recommended to protect bowl assembly.

Also...Split Case Booster Pumps in a wide range of capacities

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Pumping, Sewage Treatment, and Water Purification Equipment
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The blow of the hammer rings clear, indicating that the pipe has reached the trench side from the foundry with its rugged quality unimpaired. After this final precautionary test, each length of cast iron pipe is lowered into the earth to begin its century or more of reliable and tax-saving service. Throughout its production cast iron pipe is tested at every step, from raw materials to final inspection, by modern laboratory and production controls. All manufacturers guard to the utmost the quality reputation of a product known for longest life with lowest maintenance cost. Cast Iron Pipe Research Association, T. F. Wolfe, Engineer, 122 S. Michigan Ave., Chicago 3.

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SERVES FOR CENTURIES
LOOK FOR THIS MARK IT IDENTIFIES CAST IRON PIPE

No water treating plant is completely modern without

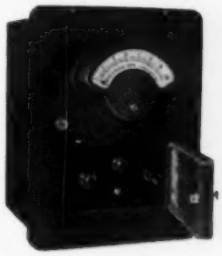
BECKMAN pH CONTROL

Beckman pH Control is the tool with which modern water treating engineers are reducing purification costs, increasing operating efficiencies and insuring a better, more uniform water supply in municipalities large and small from coast to coast.

Because Beckman Glass Electrode pH Equipment has pioneered one important pH advancement after another, it is widely recognized as the most advanced pH equipment available for all types of water and sewerage treating plants. It is installed in plants—both large and small—throughout the country.

No matter whether you are building a new plant or modernizing an older one—and regardless of its size—it will pay you to get the complete story on how Beckman pH equipment will step up efficiencies and cut costs on *your* operations.

Our trained engineers have had wide experience in this type of application and will gladly consult with you and make recommendations on the most efficient methods of solving *your particular* pH control problems. This service incurs no obligation. Write us outlining your pH problems.



This Beckman Automatic pH Indicator is the most advanced pH instrument available. Fully automatic, it gives continuous indication of pH and also operates standard types of potentiometric recording and controlling equipment.

Send for these helpful Bulletins . . . "What Every Executive Should Know About pH"—and descriptive literature on Beckman pH equipment.

BECKMAN INSTRUMENTS
NATIONAL TECHNICAL LABORATORIES, SOUTH PASADENA, CALIF.

ONE OF THE LARGEST water treating operations in the country—the Los Angeles Metropolitan Water District—uses Beckman pH Equipment throughout to insure maximum efficiency of its treating operations. This is but one of many similar Beckman pH installations in treating plants, large and small.

Typical curves showing effect of pH upon turbidity removal. Accurate pH control is essential for efficient coagulation and minimum chemical cost on all types of treatment.

BECKMAN

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OUR three generations of experience in management is useful to you because it has assured the continued and uninterrupted advancement of our company which is reflected in its present reputation as well as its financial stability and unexcelled manufacturing facilities.

As builders of hydraulic turbines, pumps, gates, hoists and automatic valve equipment for the past 72 years, we are in a position to assist you in the solution of any related problem you may have.

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If It's Hydraulics~ Put It Up to Us!

POWER by SMITH

Let Badger Meters **SAVE** *for you!*

A-IOT

For 41 years waterworks men have told us of their satisfaction with Badger Water Meters. You, too, can get "More for your money", in Badger Meters.

SC-IOT

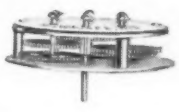
Above, left, Model A-IOT, frost proof meter, designed for cold climates. Above right, Model SC-IOT, (split case), designed for warmer climates. Oil enclosed or open type gear trains are optional.

Two Piece Measuring Chamber

Snap joint construction; no screws; all bronze. Smooth internal surface eliminates excessive wear and maintains accuracy. An actual comparison will convince you.

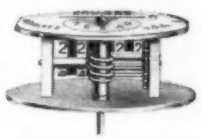
Three Piece Disc

The disc is of the flat three piece design. Component parts are made of the best grade of vulcanized rubber. Extreme care is taken to see that all parts are concentric with each other.



Circular Reading Registers

All parts of non-ferrous materials, heavily plated to guard against corrosion. All bearings are rubber bushed. Dials have heavy copper base; black letters on white porcelain for ease in reading.



Straight Reading Registers

Non-ferrous materials; heavily plated. Indestructible brass number wheels are not affected by heat. Dials are of the same high quality as used on all regular Badger circular reading registers.

Men and women of Badger Meter take personal pride in Precision Production.

BADGER METER MFG. COMPANY
MILWAUKEE 10, WISCONSIN

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R-S valve values

ISSUED PERIODICALLY BY R-S PRODUCTS CORPORATION, PHILADELPHIA 44, PA., FOR THOSE CONCERNED WITH FLOW CONTROL AND SHUT-OFF

Corrosion and Erosion in Valves

Corrosion is the major valve problem of many engineers. In the absence of any universal all-satisfying answer to the problem, R-S offers two contributions of measurable value. First is for the user who must avoid replacement and shut-down during the longest possible intervals. For such users the regular range of R-S Butterfly Valves can be had in metals of varying degrees of corrosion resistance. Thus either body or vane, or both, can be made of any specified alloy of steel, aluminum, brass, bronze, Monel metal, stainless steel, and others including R-S Products' own "A" and "H" Metals. Among these metals many acids, alkalis, and other chemicals meet real resistance to their corrosive action. Certain of the stainless steels, for example, lose as little as .00035" per month to the attack of mild solutions of sulphuric acid (more corrosive than the concentrate), and several types offer full resistance to many highly corrosive chemicals.

Some engineers hold that it is hopeless to fight corrosion; that the best policy is to surrender, buy low-cost valves, and replace frequently. For these the R-S Wafer type Butterfly Valves are a boon. They have a narrow face-to-face dimension, they are low in cost, light, easily handled, and quickly replaced. Available in all metals with free-revolving or wedge-type vanes.

Erosion is another characteristic ailment of valves against which R-S design offers advantages over the conventional type of valve. First of these is the fact that the Butterfly Valve offers minimum resistance to the flow of the material so that minimum turbulence occurs in the area of the valve. Turbulence, obviously, exaggerates the erosive effect of abrasive materials. Moreover, the vane of the Butterfly Valve is not surrounded by pockets, seats, or other impediments which contribute to turbulence. Further, the design of the Butterfly vane is such that approach to the closed position does not create a "jet" effect as in conventional valves but causes abrasive materials to "fan out" as they reach the low-pressure side of the vane.

Again, as in the consideration of corrosive action, there is a wide latitude of metals to help resist erosion. R-S "A" metal is an example of a material offering high resistance to erosion. "A" metal is a tough, dense metal of uniform grain and high endurance limit, resistant to galling, wire-drawing, and abrasive materials.

Another highly abrasion-resistant metal is the new high-Brinell Stainless Steel developed by R-S Products' engineers. This shows a Brinell figure of 1050 at 70°F. and 540 at 1100°F. as compared with corresponding figures of 170 and 121 untreated.

R-S Type 630. "H" Metal 3-way Butterfly Valve with R-S heavy duty handwheel control, self-locking worm and gear and cross-linkage mechanism. Valve has two vanes, one normally closed while the other is open.

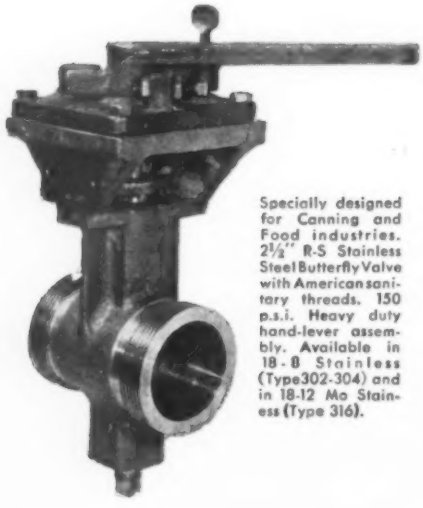
"A" Metal Case History

Illustrating the advantages both of R-S "A" metal and the butterfly type of valve is an installation in a line leading to a condenser and used for shut-off under 70 pounds pressure. Previous installations of conventional type valves had to be replaced every six to eight months as the abrasive action of the fluid in the form of a high pressure "jet" wore a hole through the casting. The length of service was tripled by using an R-S Butterfly valve made of "A" metal.

It was demonstrated that in the butterfly valve even abrasive materials "fan out" into a crescent shaped spray when the vane approaches a closed position, rather than forming a "jet" as in other types of valve. This characteristic, aided by the dense, tough R-S "A" metal produces notably good results under the hard wear and severe stresses of this service.

"A" metal is being specified in many R-S Butterfly Valves for pressures up to 900 p.s.i. under exceptionally rigorous conditions of service.

R-S Sanitary Valve for Canning and Food Industry



Specially designed for Canning and Food industries. 2½" R-S Stainless Steel Butterfly Valve with American sanitary threads. 150 p.s.i. Heavy duty hand-lever assembly. Available in 18-8 Stainless (Type302-304) and in 18-12 Mo Stainless (Type 316).

Shut-off 100% Complete —and it Stands up!

The R-S rubber-seated valve is available for service at all temperatures between —20°F. and plus 200°F. Dead tight shut-off is attained by the action of the bevelled vane against the rubber "spool," seat, or liner. The spool is made of a specially developed rubber, molded to fit the body, but almost loose in fit and easily fitted by hand, without tools.

As the vane approaches the closed position, a bunching of the rubber takes place at the shaft-bosses assuring dead tight shut-off at these critical points as well as around the periphery of the vane.

Test runs involving as many as ten thousand complete openings and closings have left R-S rubber-seated valves unimpaired as to closure. Some purchasers buy a spare rubber-spool for every three or four valves, but none has yet been needed.

The flanges of the spool are pierced to match the valve flange bolts and serve in place of the gaskets usually required.

Complete R-S Valve Installation Data

Engineers like the complete dimensional data supplied for R-S Butterfly Valves. Dimensions are tabulated by standard sizes under stock types and identified by letters corresponding to detailed drawings which accompany the tables. Six full pages of R-S Products' Catalog No. 14-B (copy on request to R-S Products Corporation, Wayne Junction, Philadelphia 44, Pa.) are devoted to this basic installation data.

JMLco P-LL2

Throughout the entire system, J-M Transite Sewer Pipe makes valuable contributions to more efficient, more economical sewage disposal. Here is a quick summary of its money-saving advantages —

Reduced Treatment Costs . . . It is conservatively estimated that more than 25% of the contents of the average sewer line is infiltrated ground water. This means unnecessarily heavy loads on disposal plants and higher treatment costs.

Transite Sewer Pipe is helping to eliminate this expense in many communities today. Its sleeve-type joints *stay* tight in service . . . safeguard against infiltration. This reduces plant loads, effecting substantial economies in treatment costs. And —vitally important in future planning—it conserves present plant capacity for tomorrow's needs.

Flatter Grades . . . Transite's high flow capacity (n=.010) often permits flatter grades, with substantial reductions in trenching costs. As an alternate saving, smaller diameter pipe may be used.

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Complete details on Transite Sewer Pipe for gravity lines are given in brochure TR-21A; on Transite Pressure Pipe for force mains and water lines, in brochure TR-11A. Write Johns-Manville, Box 290, New York 16, N.Y.

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Tristand made also with yoke vise.

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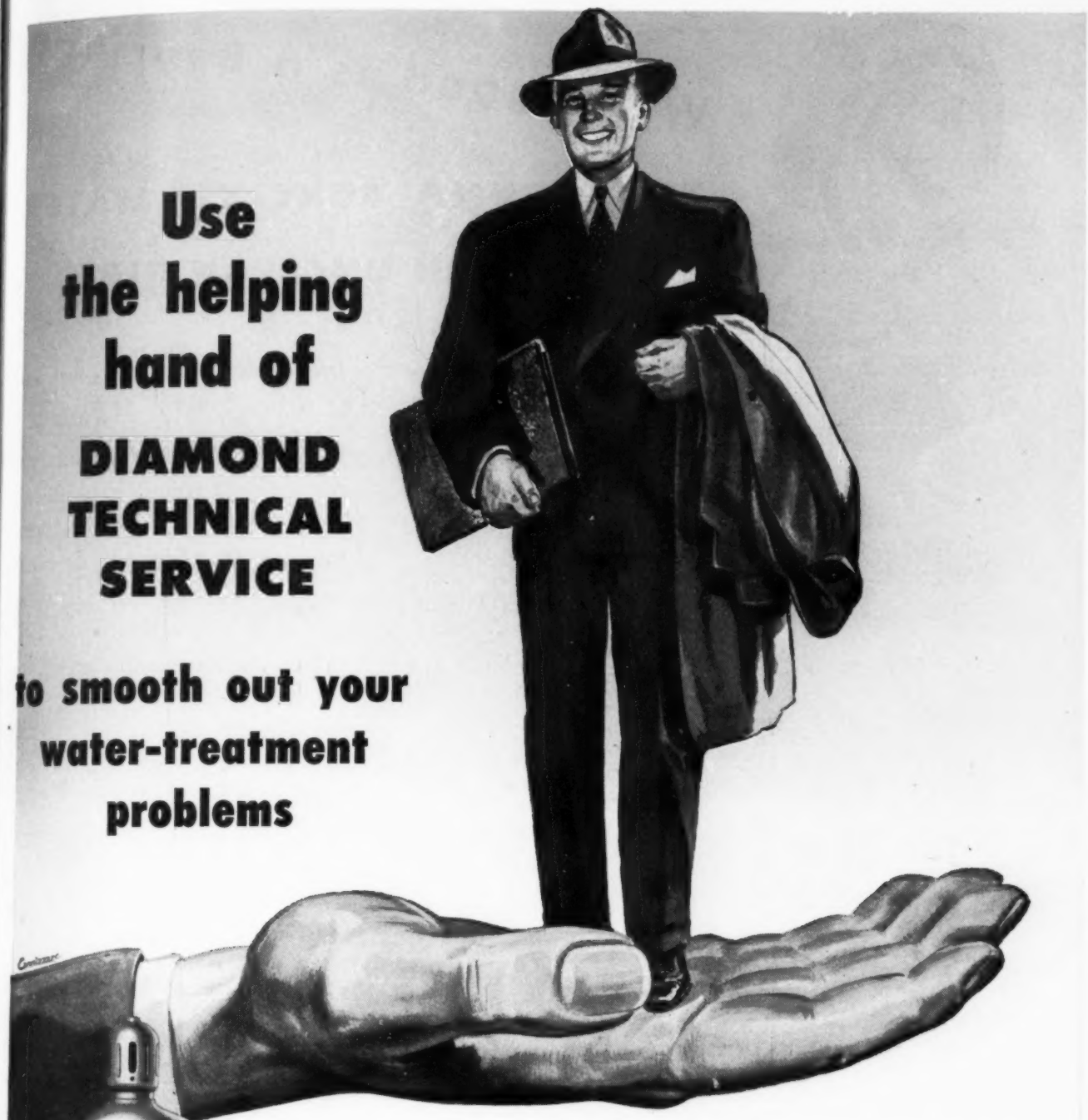
Elyria, Ohio, U. S. A.



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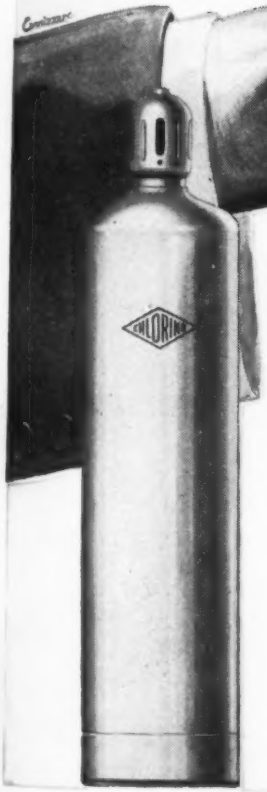

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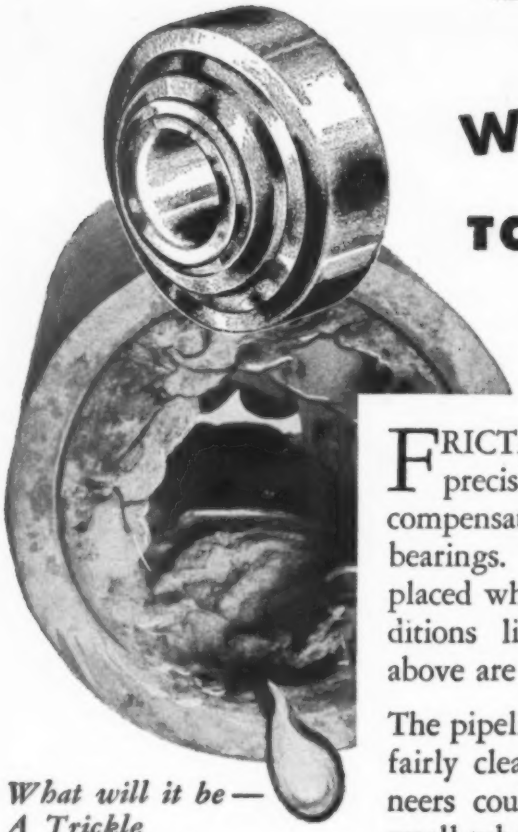

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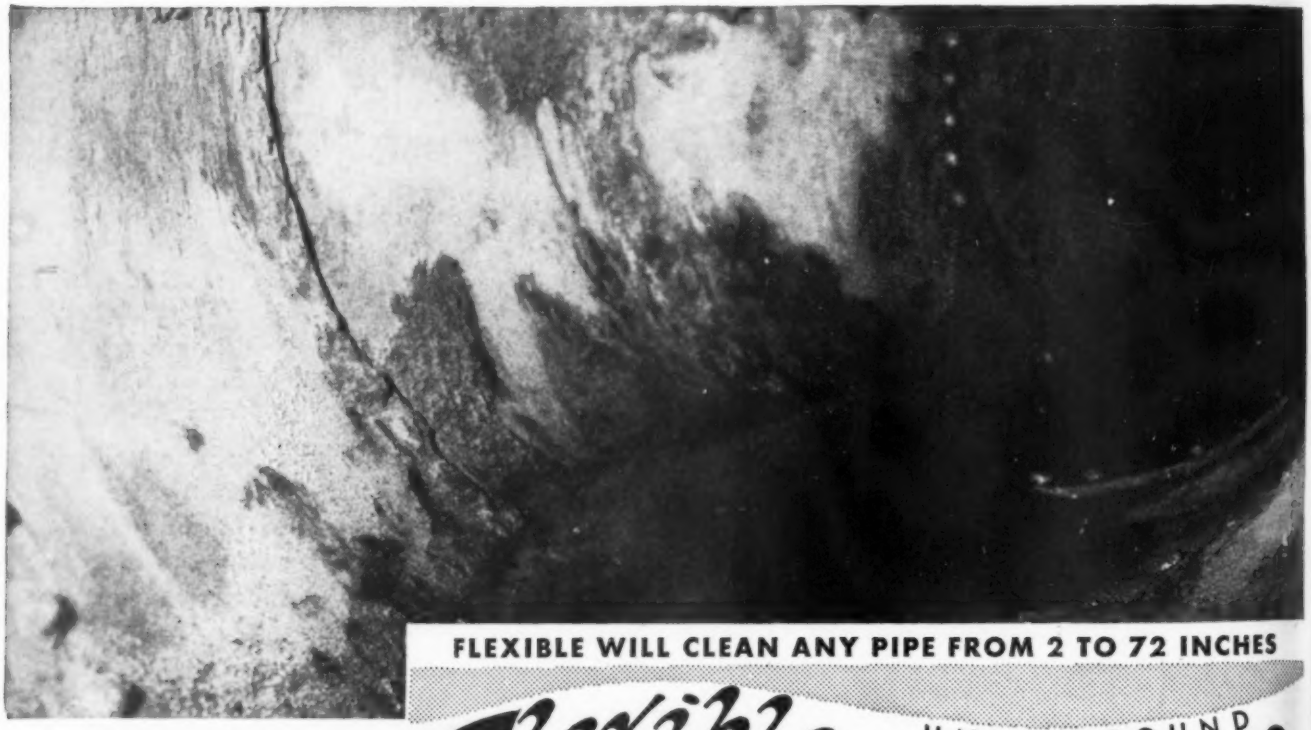

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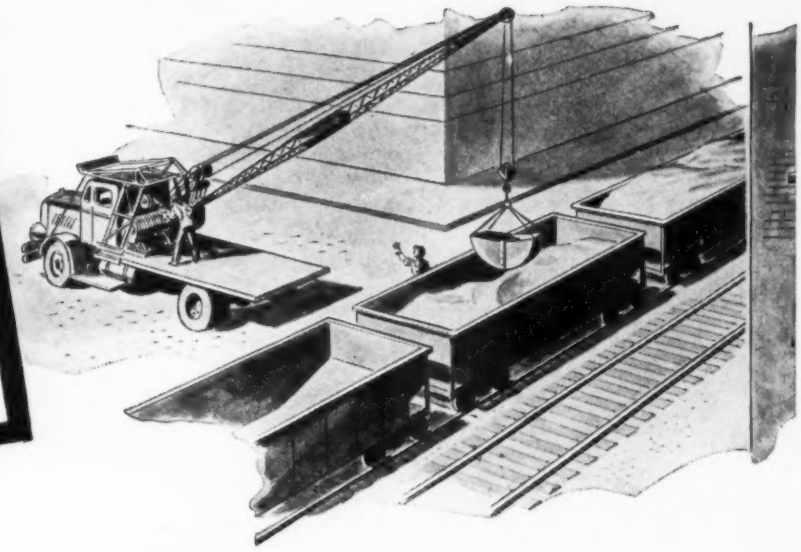

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LC-101

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We are building up our stock of split repair sleeves for emergencies, but it will be some time before we can get back to our fast, pre-war delivery schedules. Mail your orders today and you will have the sleeves when they are needed.

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Houston Office and Warehouse, 1121 Rothwell St.,
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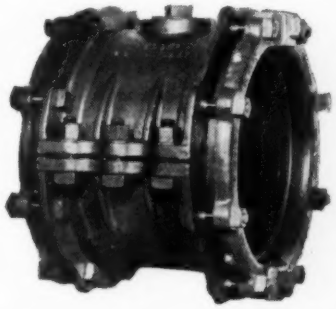
In Canada, Dresser Manufacturing Co., Ltd.,
60 Front St., West, Toronto, Ont.

Style 82—Adjustable Repair Sleeve. Low-cost, light-weight sleeve to fit varying pipe diameters from 4" to 8". Interchangeable sections give adjustability. One man can make a repair with this sleeve in 5 to 10 minutes. Ideal as tapping sleeve.



Style 57—Cast Split Sleeve. Quickly installed. For cast iron pipe 2" to 12" in diameter. Two or more of these sleeves can be joined together to enclose pipe breaks longer than 8".

DRESSER REPAIR CLAMPS AND SLEEVES

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it means...

Processes

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FOR OTHER LIQUIDS

Removal of

Undesired Impurities from Syrups, Juices and Chemical Solutions

Recovery of

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Chemical Products and Mechanical Equipment for Water Conditioning for Household, Industrial and Municipal Use; also for Conditioning of Other Liquids:

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Zeolite Water Softeners
Ion Exchange Equipment
Demineralizing Equipment
Filtration Equipment
Diatomite Filters
Chemical Feeds
Sludge Blanket Units
Cold Lime-Soda Softeners
Hot Process Softeners
Continuous Blowoff Systems
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because offered by recognized leading water-conditioning experts and pioneers, with more than a quarter century of experience in this field.

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Be ready to make quick, permanent repairs when pipe breaks occur this winter. Order your Dresser Sleeve and Clamp requirements *now*.

We are building up our stock of split repair sleeves for emergencies, but it will be some time before we can get back to our fast, pre-war delivery schedules. Mail your orders today and you will have the sleeves when they are needed.

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Style 57—Cast Split Sleeve. Quickly installed. For cast iron pipe 2" to 12" in diameter. Two or more of these sleeves can be joined together to enclose pipe breaks longer than 8".

DRESSER REPAIR CLAMPS AND SLEEVES

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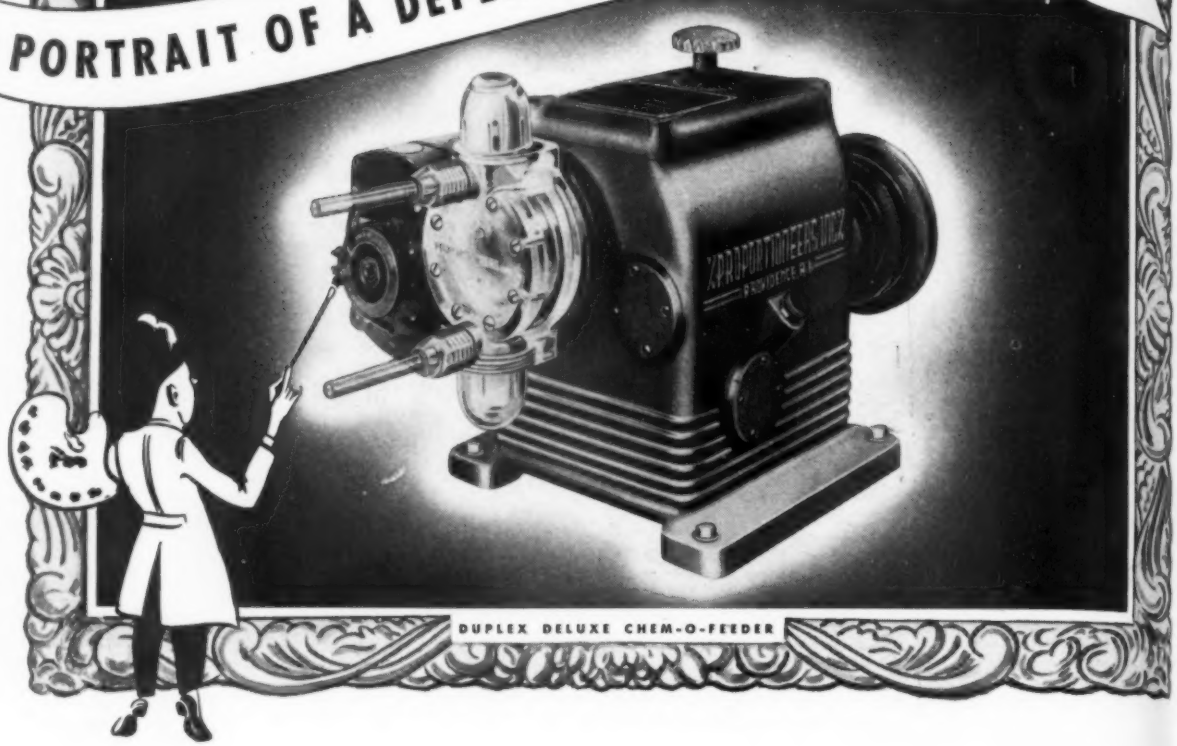

DESCRIPTION:

The Heavy Duty Chem-O-Feeder is a constant rate of feed, manually adjustable diaphragm pump equipped with "See-Thru" plastic reagent head. By turning stroke length adjusting knob at top of unit, dosage is adjustable over a 10:1 range while the feeder is operating. Wide variations in feeding rate are made by three-step cone pulley and belt arrangement which changes the stroking rate. The Chem-O-Feeder is driven by 1/6 HP motor and is designed for feeding against line pressures up to 100 p.s.i. Moving parts of unit are enclosed within a one-piece cast iron mechanism box and operate in an oil bath for maximum service life with minimum maintenance expense.

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Max. Chemical Delivery — 9.5 GPH (at 10 psi)
8.3 GPH (at 100 psi)

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SHIPPING INFORMATION:

Net Weight	92 lbs.
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L. H. ENSLOW, Editor
155 East 44th Street, New York 17, N. Y.

COMING!

"A Look at the Record!"
While this is Ye Ed's choice of title and not the author's such could well be justified as the caption for the story of the first five years of operation of the activated sludge plant of Gary, Indiana. In the past we have on more than one occasion referred to the consistent results from the Gary Treatment Plant and the value of power recovery through operation of gas engines. The forthcoming article further emphasizes these facts. The author is—

W. W. MATHEWS, Supt.,
Gary (Indiana) Sanitary District.

"Improving Water Plant Operation"
The third of a series of articles on this topic deals with the problem of low-temperature coagulation, with particular reference to the effectiveness of activated silica as a coagulation aid in cold weather, when rapid and efficient flocculation is most difficult and tender floc becomes a problem. The author of "New Concepts of Coagulation" and the current series of helpful advice is—

HAROLD R. HAY, Chemical Engr.,
The Philadelphia Quartz Co., Philadelphia.

"Treatment of Wool Scouring Wastes at a Profit"
Now that all facts and figures can be revealed, and substantiated by plant operating results, this somewhat delayed paper will describe plant design and a new process of purifying wastes from wool-scouring plants. Originally designed as a treatment to alleviate stream pollution, it develops in the perfection of the process that through the recovery of grease of high purity, resulting from the chlorination procedure, such grease sells at a price to yield an actual profit from the operation. This article reveals plant scale results of sufficient duration to be conclusive as to both the technical aspects and economics of the process and plant operation. The authors are—

HARRY FABER and PAUL HOWARD,
The Chlorine Institute; Consult. Engr., Boston.

"Cathodic Protection Experience on a Steel Water Supply Main"
Is a story of maintenance experience in connection with the important 8.25 mile Bonita Pipe Line of 28 inch steel pipe serving as a transmission main for San Diego, Calif. Experiences with, and results from Cathodic protection of their 8 mgd. pipe line since 1942 are especially significant. As the result of a careful study, findings with respect to location, characteristics, methods of installation and operation, and the maintenance and renewal of anodes, make possible a number of specific recommendations.

"Trickling Filters—An Evaluation"
Is, as the title indicates, a survey of the fifty-year history of trickling filters, their design, construction, application, operation, and results, under various conditions. In addition the subjects of effect of pre-treatment, filter media, recirculation, distribution, and standard, high-rate, and roughing filters are discussed by the author—

DOUGLAS E. DRIER, San. Engr.,
Walker Process Equipment Co., Aurora, Ill.

"Chloroben In Sewage Treatment"
Is the title of an article which deals with experiments at Los Angeles in the control of coliform bacteria and hydrogen sulfide formation in the sewers. With new and recent data on experimental work, the original report on this chemical is expanded, brought up-to-date and re-evaluated by—

REUBEN F. BROWN, Supt.,
Sewer Maintenance, Los Angeles, Calif.

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THIS COULD BE YOUR TOWN!

The Daily

NEWS SECTION MONDAY,

Water Department Increases Revenue and Reduces Water Rates

Council Congratulates Superintendent On Payment of $29000

Regular Meter Testing Program Given Credit for Economies

As a result of his outstanding performance, the Town Council today at a special meeting accepted reduced rates and highly congratulated Superintendent — of the Water Works for his services. Today the Water Department is one City Department that not only seeks no budgetary appropriation from the Common Council, but actually pays money in taxes. The Department is turning over yearly in cash an average of about $29000. As a result of last year's business, it has been determined that a further reduction in rates is possible, to a point that is now the lowest in the history of the plant. In a special interview with the Superintendent, a reporter from the Inquirer obtained figures to show how this remarkable result was achieved.

The Superintendent in his work has accumulated a large fund of statistics about his water meters, which assists him in his operations. One of the most interesting facts is that some 13% of all water used in the domestic household is run at the rate of about ¼ gallon a minute. As a result, domestic ⅝" meters are being repaired to test up to 95% or better on ¼ gallon a minute. Due to this high standard of meter efficiency, a greater proportion of the water pumped is now being paid for than ever before. This is one of the factors accounting for the increase in revenue.

It is notable that in a representative group of 229 meters which were in service an average of 73½ months, the cost per meter for repair materials was only 24.2 cents.

Modestly disclaiming a great deal of credit for the results achieved, the Superintendent praised his hard working men in the Water Department, and the advisory assistance given him by the representative of the Neptune Meter Company.

(Figures quoted above based on actual practice)

WATER & SEWAGE WORKS

VOL. 93, No. 11 NOVEMBER, 1946

A Gillette Publication

THE SANITARY ENGINEER LOOKS FORWARD

By ABEL WOLMAN*

Professor of Sanitary Engineering
THE JOHNS HOPKINS UNIVERSITY
BALTIMORE, MD.

AT THIS first Inter-American meeting of sanitary engineers and public works officers, I have been assigned the vulnerable task of attempting to present a prospect in the field of sanitation over the next several decades. Even under the most favorable circumstances a prophet is literally "without honor in his country." Fully realizing the risks of prophecy, it still seems helpful to let one's imagination range over the field with the indulgence of the representatives at these sessions.

Many years ago the late President A. Lawrence Lowell of Harvard summarized the years following wars in these terms:

"It is hardly an exaggeration to summarize the history of four hundred years by saying that the leading idea of a conquering nation in relation to the conquered was in 1600 to change their religion; in 1700 to change their laws; in 1800 to change their trade; and in 1900 to change their drainage. May we not say that on the prow of the conquering ship in these four hundred years first stood the priest, then the lawyer, then the merchant, and finally the physician."†

This all too brief summary, with the necessary modifications and expansions appropriate to the complex world in which we now live, is as generally applicable today as it was many decades ago. The damages created by war were paralleled by the realities of the peacetime periods before World War II. A review of the countries of the world prior to 1933 would have disclosed the need for immediate service in the field of sanitation, a need only dramatized by the exigencies of war.

The Author

Destruction of water supplies in the Ruhr, the damage to sewerage systems in Coventry, the destruction of the water supplies of Manila, either by direct bombing or by deliberate sabotage, re-emphasized the importance which these orthodox necessities of normal living played even in most favored countries. Cholera, typhoid, dysentery, malaria and typhus, only a few of the scourges of the world, are not alone war-borne. They are the normal accompaniments of the peace-time pursuits of man. The unsanitary conditions which caused them prevailed before the war and confront us throughout the world after the war.

History merely demarks the cyclical rises and falls in their intensities. Wars, depressions, and famines awaken the world to this continuing of the struggle of man for protection against his own environment.

It is not an exaggeration to say that Great Britain, France and the United States of North America would all derive advantages from the effective control of yellow fever or malaria. While China or Iran would no doubt benefit from the sanitary engineering experience of the Western world, this does not mean that the Western world itself is living in a Utopia freed of the necessities of controlling the environmental diseases.

This much only can be said, that in those countries blessed with rich resources, with organized public service and with a rapid rate of public works installation, progress in the control of the environmental diseases has been more rapid. How to transmit these blessings to countries or parts of countries historically less favored thus becomes perhaps one of the most important future assignments of the statesmen in sanitation. For India, with its 400,000,000 people; for China, with its almost 500,000,000; for the 250,000,000 Europeans, the 100,000,000 Arabs, the 185,000,000 Russians, and the 200,000,000 Latin Americans, the problems of sanitation are essentially the same as those which confronted us in the past and will press us for the future in North America.

The differences in problem throughout the world or within the Western Hemisphere alone are those of timing, of finance, of social organization and public persuasion. Chal-

*A paper presented by Dr. Wolman as chairman of the Sanitary Engineering Committee of the Pan American Sanitary Bureau, before the Inter-American Regional Conference on Sanitary Engineering at Rio de Janeiro, June 10, 1946.

†c.f. C.E.A. Winslow, "International Organization for Health," Commission to Study the Organization of Peace, 1944, New York, N. Y.

lenges such as these to the sanitary engineer are not limited by political boundaries, by language, by racial difference or by economic philosophy. They must be met on each ground within the framework of geographical and political setting. It is still true, as Professor George C. Whipple pointed out many years ago, that "the world is bound in bacterial bonds." To break those bonds requires energy and perspective on a world wide base and not upon a nationalistic adherence to geographical or political limits of activity.

What Ails the World?

To discover future possibilities and necessities for sanitary engineering function one need only to turn to a brief review of the diseases that disable and kill in the world. What are they, where do they occur, and when may they be conquered with the resources now available? Many years ago I pointed out that "the ghosts of environmental diseases have been laid in literature but not in fact." Once more war has reminded us of the validity of this observation. The same thought was exemplified in the country of one of your associates, Dr. Afranio Peixoto, when he stated in 1941 that "an enfeebled pestilence is not a danger past."

The key to the future activities of the sanitary engineer, therefore, must rest upon the fact, as Colonel Dieuaide has so well stated, that "preventive medicine has not yet abolished any disease. The price of health security is eternal vigilance."

My emphasis on these considerations stems from the fact that the superficially minded, the hasty diagnostician, and the "nouveau" expert, all jumping from one new slogan to the next, tend to forget that the victories of the past presuppose continued protections for the future. Control of the environmental disease cannot rest upon such fits and starts of organization or concept.

In a recent discussion of China's health problems, Dr. Szeming Sze points out that on any one day among the 400,000,000 people of China, 16,000,000 persons are sick. With a death rate of 25 per 1,000, over ten million people die every year. He estimates that of the 10,000,000 deaths, 4,000,000 are unnecessary deaths each year and probably three-quarters of these unnecessary deaths are attributable to the excessive incidence of gastro-intestinal diseases, the infectious cases of infant mortality and pulmonary tuberculosis. No inconsiderable portion of this morbidity and mortality is due to the absence of any of the elementary provisions for the protection of water supply, for the elimination of sanitary wastes or for the control of insect-borne disease.

In India the situation is more than paralleled. The toll taken by the gastro-intestinal diseases, by the diarrhoeas of children, by the malarias of all ages is staggering in its magnitude and devastating in its restrictions in the opportunity of people to develop their resources to the utmost. So widespread and so dramatic are these tolls in India that in the 1945 issue of the British Who's Who, a distinguished leader in India lists under the heading of his "Recreation": "propaganda for rousing the sanitary conscience of the people in the matters of public health . . . research in intestinal flagellate protozoa and fermentation bacteria." Even allowing for the strong diversions which this intellectual may permit himself, it is a tribute to his recognition of the plight of his people that these efforts in the field of sanitation loom large in competition with the more familiar tennis, walking or swimming.

Conditions, of course, are paralleled in almost every country of the globe where the diseases of filth still reign supreme as the major cause of death and of misery while still alive.

Many observers have already pointed out that these problems of the environment cannot be disposed of or masked by referring to them as "tropical diseases." They are neither tropical in origin nor restricted by latitude. Historic accident may emphasize their tropical location, but the conditions which engender them cannot be easily or accurately relegated to the tropics.

Colonel Dieuaide properly points out that there are in fact few truly tropical diseases. The diseases so classified are the stock in trade of India and China, for example.

Cholera and plague are tropical only because they have been successfully driven into areas not yet capable of wiping them out. By the grace of God, money, and sanitary organization, they are rare in Western Europe or the Americas. No one, of course, discounts the relationship of geography to disease, but in the field in which we are today active the future holds challenges to the sanitary engineer that are not circumscribed by the tropics or by the remote areas of the world.

When we compare, for example, the principal causes of death in the United States of North America and in Latin America, we find the major difference in the problem is one of time. In 1900, diarrhoea-enteritis and typhoid fever were among the 10 leading causes of death in the United States. In 1937, diarrhoea-enteritis was still among the 10 leading difficulties. Typhoid fever had been curbed, not abolished, as will be pointed out later on.

In Latin America, however, the six diseases or combinations of diseases which seem to stand out as the principal causes of death are tuberculosis, diarrhoea-enteritis, infant mortality, malaria, pneumonia and heart disease.

Perhaps the major health problem of Latin America as a whole is malaria when we consider its complete incapacitating power. Even though dysentery and the general intestinal parasites do not appear among the six principal causes of death in Latin America because their killing power is low, they still present one of the major problems in public health because of their profound debilitating effect on individual vitality.

If we were to review these statistical implications of environmental diseases of the world as a whole, we cannot escape the conviction that the diseases subject to the controls by the engineer will be by far the most important health problem confronting the world for many decades. It is not too much to say that the greatest probable source of accomplishment in the reduction of morbidity and mortality in the world would be through environmental sanitation.

The Future Functions Of the Engineer

All that has been said above make it reasonably obvious that the engineer of the future is confronted with both an unlimited task and an engrossing opportunity. The normal functions which he has been called upon to perform in the past are all too familiar to you. His functions for the future in the fields of water supply, sewerage, air control, housing, insect control, rodent control, remain essentially the same. Their geographical spread, their rate of application, their expansion in understanding will all need to be speeded up. Perspective will no doubt require an expansion beyond that ever envisioned before. These opportunities in the post-war period are well summarized, even though briefly, in the opening paragraph of the Progress Report of the Committee of the American Society of Civil Engineers on Advancement of Sanitary Engineering, 1946. The committee's words are as follows:

"All surveys of the personnel needs

of the postwar world indicate an increased demand and expanding field of service for sanitary engineers. In the realm of public health; in the design, construction and supervision of sanitary works; in the armed services; in far-flung relief and rehabilitation activities; in educational work; in many types of industry; in the design, manufacture and sale of sanitary equipment; in the food handling and processing industries; in some fields of municipal government; in the vast and long-neglected realm of housing, and in many other activities—there is increasing need for the services of trained and experienced sanitary engineers."

That there is much to be done everywhere cannot be gainsaid. It is appropriate perhaps to point out that these comments are as pertinent to our activities in North America as they are in Latin America or any other country in the world. It is too early to forget that in the latter part of 1939 in the Manteno State Hospital of Illinois 543 cases and 60 deaths occurred from a typhoid fever epidemic. The causes may still appear to be debatable, but strong evidence implicates the water supply of that institution, which showed evidence of pollution by sewage.

During 1943, for example, there were 389 outbreaks of disease in the United States of North America transmitted by food or water. They caused 25,665 cases of reported illness and 56 deaths. The unreported cases probably represent many times those actually listed.

These "ghosts" of the environmental diseases still walk the streets of North America.

The Problem of Money

One of the great difficulties in the control of environmental diseases is that any effective procedure requires money. The pernicious cycle of disease to poverty to disease represents perhaps one of the most important challenges to the sanitary engineer. What are the devices by which environmental structures may be designed, constructed and operated more cheaply than they now are? By what measures is it possible to reduce the unit cost of purifying water, of treating sewage, of controlling insects and rodents?

In some of these fields the war fortunately has produced possibilities of materials and of equipment which are less expensive than those available before the war. Some of these have immediate application and use in the control of environmental diseases. The engineer, however, must develop new techniques of financing which would make it possible for governments throughout the world to apply the known solutions to the devastating problems of disease.

These meetings will offer an opportunity for much discussion on the problems of financing the installation and the operation of many devices for sanitation. It has long been my judgment that too little study has been given to financial procedures. Those matters have been too frequently relegated to administrative officers unfamiliar with their importance or insufficiently ingenious to develop new procedures for paying for sanitary installations. The provision of money is an essential sanitary engineering objective which must be emphasized for speeding up future activity.

What relationship there should be between central and local governments in the provision of money is not only a matter of political philosophy from country to country but also a matter of local availability of funds. In some countries it is no doubt true that most of these activities can be adequately financed through local units of government. In others it is equally obvious that central governments must do much in the next decade to help carry the financial burdens made necessary by sanitation.

I have no pretension to being able to point out where these real responsibilities should be lodged. They are mentioned here primarily to focus attention on their key importance to sanitary e n g i n e e r i n g progress throughout the world.

Administrative Structures

Of almost equal importance in the introduction of sanitary reform in any country is the development of the administrative structures necessary to execute and to operate the installations required. Here, too, political philosophy dominates the scene.

There is perhaps no general law, other than that of expediency, which will determine how much local autonomy and responsibility should prevail in contrast with the responsibilities of the central government. Each country again would probably find the most successful relationships established out of the history of its attributes, its political origins, its racial combinations and its advance along the road to healthy democratic institutions.

In this field, too, the sanitary engineer has a part to play. He must familiarize himself with the lessons of other countries in administrative management and structure. He cannot, of course, slavishly apply the lessons of other countries to the solution of the problems of his own country. He can, however, suggest and d e v i s e administrative structures which would facilitate the purely managerial phases of environmental sanitation. He should be able to share the values to be obtained from central government stimulation with the preservation of local autonomy and responsibility. The countries in Latin America, for example, give demonstrations over the entire spectrum of central-local government equilibrium. Such a permanent group as is here assembled should in the course of time introduce objective analyses of those various forms of governmental administrative structures. Out of such analyses should come various examples of how best to establish the governmental machinery for the most rapid and effective introduction of sanitary structures and measures.

Education and Research

To accomplish the objectives all too briefly discussed, the development of sanitary engineering staffs will be required. Such development will place upon the universities of the Americas a task which cannot be lightly treated. Here, too, this group should in the not too distant future evaluate the requirements, the status and the type of education and training which will be demanded for the most effective practice of sanitary engineering.

Suggestions for curricula for accredited schools of sanitary engineering and public health may very properly be one of the early assignments of such a group as this.

A necessary concomitant of a program of education for professional workers lies in the field of research. Much remains to be discovered in the general field of environmental sanitation. Many investigative tasks are still ahead. Fundamental data on many of our activities are still lacking.

The development of essential features of a research program is an additional assignment to serious-minded members of this group.

Professional Status

All of us are aware that the sanitary engineer not only has a struggle with the physical environment, but has likewise the task of strengthening his capacity and his position in the field of public health activity.

This cannot be accomplished by sleight of hand.

His status in the future, whether strong or weak, will rest upon the quality of his equipment and of his performance.

One of the best ways of intellectual group-fertilization is in the strengthening of such a professional group as here assembled. The range of problems which it might with profit discuss and survey covers the status, the professional training, the pay and the public position of the sanitary engineer. All of these will be issues of the future which remain to be argued, measured and promulgated.

Summary

Problems requiring the energies of sanitary engineers are world-wide in character. They are intellectually stimulating and cover a service to the people of the world transcended by no other activity. A necessarily limited review of these problems and of possible solutions has been presented. A scope of activity has been defined for the sanitary engineer of the future, which can be no longer delimited by the purely technological. Political philosophy, financial program, administrative structure and public education are all essential bases for sanitary engineering action. Technology alone will not bring on the rapid correction of the evils engendered by insanitation.

Although I might not aspire to the heights of imagination exemplified by the following comments of one of our contemporary authors, I cannot escape the essential validity of his argument. His words are a fitting closure to the limited observations here made:

"Let no cultivated reader despise these details (lavatories, sinks, sewers and manholes.) There is no truer sign of civilization and culture than good sanitation. It goes with refined senses and orderly habits. A good drain implies as much as a beautiful statue. And let it be remembered that the world did not reach the Minoan standard of cleanliness again until the great sanitary movement of the late nineteenth century." J. C. Stobart, "The Glory That Was Greece."

Joseph Bradley Honored

Indiana's Dean of Water Works Operators Retires After 56 Years at Valparaiso

Joseph F. Bradley, Superintendent of the Valparaiso, Ind., Water Works, and known as the dean of water works operators in Indiana, was recently honored on his retirement after 56 years of service.

At a regional meeting of the Indiana Section of A. W. W. A., Mr. Bradley was presented with a Life Membership in the Amer. Water Works Assn. The meeting was attended by 155 persons, and the presentation was made by Thomas J. Burrin, of Lebanon, Chairman of the Indiana Sect., A. W. W. A.

Mr. Bradley first joined the water company when it was operated as a private utility in 1887, at which time there were but two employees, each working a twelve hour shift. In 1904, when the city took over the plant, "Joe" Bradley was made chief engineer, and later superintendent, the position he has held for more than forty years.

A year ago, Mr. Bradley received the Jos. N. Hurty Award "for having served in the development of a safe potable water supply more than 25 years." Mr. Bradley was an organizer and charter member of the Indiana Section of A. W. W. A. He is also the local weather man (cooperative meteorologist) of the U. S. Dept. of Agr., a "thank you" job he has held for 31 years.

Kentucky-Tennessee Section Fosters New Sewage Works Assn.

Industrialist Elected First National Director

At the close of the recent meeting of the Kentucky-Tennessee Section of the Am. Water Works Assn., a group of its members met with W. H. Wisely, Exec. Secy., and George Russell, Vice Pres. of the Federation of Sewage Works Associations, in Knoxville, Tenn., on Oct. 30th to form the Ky.-Tenn. Sewage Works Assn.

The new association will hold meetings annually and concurrently with the meetings of the Ky.-Tenn. A. W. W. A. Section, such as has been the case in North Carolina for some years, and also in other instances. The Secretary-Treasurer of the Water Works Section will also serve as the Secy.-Treas. of the Sewage Works Section.

Interestingly, and significantly we believe, there were a number of men present at the organizational meeting who represent industry and have a special interest in industrial pollution and the possibilities of developing an economically sound and practical solution of this problem. Even more interestingly, from the four nominees for the office of Director on the Sewage Wks. Federation Board of Control, the nominee elected is a top-flight representative of an important American industry facing the problem of stream pollution correction.

The officers elected to direct the destinies of America's youngest Sewage Works Association are:

President—Clark Duggan, Chief Engr., Kentucky Dept. of Health, Louisville.

Vice-Pres.—Julian Fleming, Asst. Prof., Hydraulic & Sanitary Eng., University of Tenn.

Secy.-Treas.—Paul R. Farrell, Chief Engr., Tenn. Dept. of Health, Nashville.

Federation Director—James Ellis, Genl. Supt., Tenn.-Eastman Corp., Kingsport, Tenn.

Unusual Form of Pollution Abatement Order

The State Sanitary Water Board of Illinois, at a recent hearing in Springfield, ordered the City of Mendota to discontinue the discharge of wastes from its sewerage system or sewage treatment plant which would result in pollution of the Little Vermilion River or its tributaries.

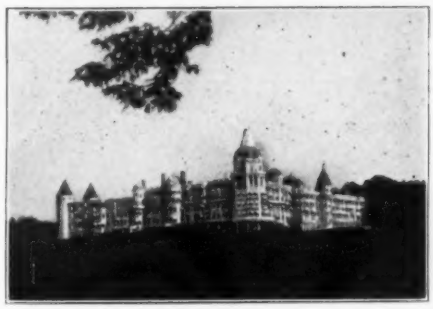
This unusual action resulted from recent pollution caused by the improper operation of the municipality's sewage treatment works which permitted effluent to be discharged to the Little Vermilion River that caused the destruction of a large number of fish.

In carrying on its program for the cleanup of streams in Illinois, the Sanitary Water Board actions in the past have been those ordering municipalities to construct and operate sewage treatment works. The recent action is one of the first orders to be issued on a municipality which already has adequate treatment *facilities*, but has been negligent in the proper operation of such.

Violation of the abatement order involves a penalty of $100 a day fine for each day's violation after Oct. 16, 1946.

NEWWA'S 65th ANNUAL MEETING AT FAMED POLAND SPRING

Attendance 541



Poland Spring House from Golf Course

Presidents

(Incoming)
Arthur L. Shaw
Cons. Engr.
Metcalf & Eddy
Boston, Mass.

(Retiring)
H. W. Griswold
Asst. Gen. Mgr.
Water Bureau
Hartford, Conn.

IT MAY have been the lifting of wartime travel restrictions; it may have been the opportunity to take a first vacation since the war; it may have been another indication of Americans' determination to go some place; it may have been a desire just to enjoy the beauty, the serenity, the food, or the famed water of Poland Spring, Me.; it may have been the technical program provided; or it may have been a combination of all these factors, but whatever the reason, the attendance record of 541 registrations at the 65th annual meeting of the New England Water Works Assn. constituted a record for the meetings held at Poland Spring.

Other statistics on this meeting: 240 of the registrants were guests (non-members) and most of these were wives; 76 associate members (manufacturers) were represented by 152 persons; and there were 38 interesting displays by water and sewage works manufacturers. Golf, dancing, a costume party, cocktail hours, music, an entertaining dinner speaker, walking, riding, and good eating were the diversions offered.

Members Exec. Committee

S. S. Anthony
Supt.
Water District
Augusta, Me.

Jos. C. Knox
Sr. Engr.
Mass. Dept. Health
Boston, Mass.

Business Meeting

In addition to hearing committee reports, the chairman reported that the count of ballots revealed the election of the following officers for the coming year:

Medal Presentation

George A. Sampson, Awards Committee Chairman (right), presenting to Col. F. F. Longley the Dexter Brackett Medal. President Griswold looking at the medal.

President

Arthur L. Shaw, Partner
Metcalf and Eddy, Engrs.
Boston, Mass.

Vice Presidents

Donald C. Calderwood, Supt.
Pennichuck Water Works
Nashua, N. H.

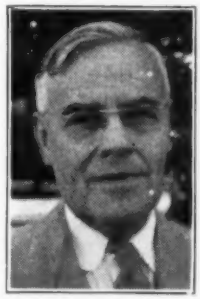
Arthur C. King, Supt.
Taunton Water Works
Taunton, Mass.

Directors

Sidney S. Anthony, Supt.
Augusta Water District
Augusta, Me.

Joseph C. Knox, Sen. San. Engr.
Mass. Dept. Pub. Health
Boston, Mass.

Phillip G. Holton, Ch. Engr.
Water Supply Board
Providence, R. I.



Vice-Presidents

(First)
D. C. Calderwood
Supt. & Engr.
Pennichuck W. W.
Nashua, N. H.

(Second)
Arthur C. King
Supt.
Water Works
Taunton, Mass.

Treasurer

William P. Melley, Supt.
Water Works
Milton, Mass.

Secretary

Walter C. Conroy, Supt.
Belmont Water Dept.
Belmont, Mass.

Editor of Journal

George C. Houser
Metcalf & Eddy Engrs.
Boston, Mass.

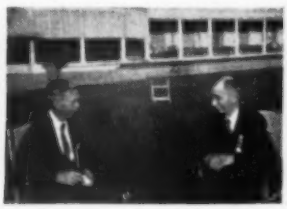
Dexter Brackett Medal to Longley

For his paper, "Prestressed Reinforced Concrete Pipe," the Dexter Brackett Memorial Medal was presented to Francis F. Longley, Vice Pres., Lock Joint Pipe Co., Ampere, N. J. The presentation was made by George A. Sampson, Chairman of the

Secretary and Treasurer

Walter C. Conroy
Supt.
Water Dept.
Belmont, Mass.

Wm. P. Melley
Supt.
Water Dept.
Milton, Mass.



Here and There at Poland Spring

George Sampson and Theo. Bristol doing their daily dozen on the croquet court in front of the hotel.

Mrs. Wally Miller (Ossining, N. Y.), John Burwell, Supt. at Schenectady, N. Y., Mrs. Jack Diven (Jackson Hgts., L. I.) and "Leadite Jack."

Karl Kennison, Chief Engr., Metro Distr. Water Comm., Boston, and an old crony, Wm. H. Powell, Chf. Engr., Water & Sewer Board of Greater Vancouver, B. C.

Two of the little old Shaker ladies, in their quaint costumes and bonnets, chatting in the hotel lobby.

"Rollie" Leveque and Mrs. "Rollie" (front row); Virginia Symons (Doc's wife) and the Omega Harpers of Chicago.

Award Committee. Mr. Longley's paper was presented at the 64th annual meeting held in Boston last year and was printed in the NEWWA Journal and also in the December 1945 issue of *Water Works and Sewerage.*

"Jo" Lufkin— 55-Year Conventioneer

Although no award was given, "Jo" Lufkin, Red Hed Mfg. Co., was publicly cited for his continuance attendance record, he having been in attendance at every one of the last 55 annual meetings of the NEWWA. Says "Jo": "There won't be 55 more, but there will be quite a few." And he looks it.

Committee Reports

In spite of a membership of 826, showing a gain from the previous year, and in spite of plans to increase advertising rates for the Journal by 50 per cent, the budget for the ensuing year will exceed income by $1,000. On recommendation of the Finance Committee, to meet the deficit expected in the next year it was voted to use $1,000 out of the $25,-987.43 surplus, rather than to raise member dues.

During the past year there was no water works legislation in New England except in Massachusetts, where three items were of interest. One of these concerned the Town Manager form of operation; another dealt with diverting of water works income to other departments; and the third provided for purchasing of water in emergencies from the Boston Metropolitan Water Board at $40 per mil. gal.

The Committee on Committees discontinued two committees (Wartime Activities and Post War), continued 33 committees, and instituted two new ones (a Technical Committee on Specifications, and a Joint Comm. with A. W. W. A. on Water Quality). For the present it was voted not to form a Committee on Public Education, although the Exec. Comm. will consider the matter of Public Relations more fully at its deliberations.

The Committee on Cathodic Protection under the chairmanship of Don Calderwood reported that a progress report will be forthcoming at one of the regular Boston meetings of the association. The committee on Operator's Salaries under W. B. Bushway had only a progress report. H. W. Griswold, Chairman of the Comm. on Gate Valves, said that the specifications should be widened, and Roger Esty, Chairman of the Comm. on Hydrant Spec., said his committee is standing by for the A. W. W. A. report on Hydrant Specs. in order that one standard may be set up. According to W. S. Mariner, the Comm. on Laying Cast

At the Wednesday Night Costume Party

The "Sid" Anthonys Water Distr. Augusta, Me.

The John Burtons Roberts Filter Darby, Pa.

The Gale Lemoines Homelite Corp. Boston, Mass.

W & T's Ed Rothman Bridgeport, Conn.

Allen Symonds Millbury, Mass. Mrs. Roy Wendell Skowhegan, Me.

The M. W. Gillespies Pbg. Pipe Cleaner Phila., Pa.

Connie Hubbard Robt. Molloy D. L. Marr Co. Boston

"Herb" Holberg, V. P. Jim Cook, Jr., Mgr. % Proportioneers, Inc. % Providence, R. I.

John W. Hughes, Supt. Harwich, Mass. and Charlie Bachmann Neptune Meters New York

Madison Goff, Supt. Milford (Conn.) Water Co. "Scotty" Marshall, Supt. Georgetown, Mass. "Bud" Moore Neptune Meters

Otis S. Tolman, Supt. Sharon, Mass. and Harry A. Nutting, Supt. Newmarket, N. H.

L. F. Moran N. E. Representative and Walter R. Johnson Asst. Sales Mgr. Hayes Mfg. Co. Erie, Pa.

Mrs. "Sid" Anthony, Chmn., Ladies' Entertainment, (seated), supervising ladies' putting contest. Jack O'Reilly (Hersey Meters), official scorer, at table.

The contest is on! The winnah (not in picture) Mrs. Karl Mann. Take a lesson, Karl!

In this foursome—W. A. Healy (Concord, N. H.), L. W. Trager (Concord, N. H.), Col. Hardenberg (N.Y.C.), Jim Sampson (N. Y. C.)

Men's putting contest. Scorer "Bill" Melley nearest camera on the perfect green.

Judges in ladies' contest: Mrs. Don Calderwood (Nashua, N. H.) and Mrs. Arthur Burke (Augusta, Me.) at table.

The Putting Contest and a Foursome

Iron Pipe is also waiting for the A. W. W. A. report, and Stanley Dore reported that the same held true for the committee on Reinforced Concrete Pipe.

H. W. Griswold reported that on the matter of Sluice Gates, it is proposed that there be a revision of testing procedure. Arthur L. Shaw, Chairman of the Comm. on Cast Iron Pipe, which is a part of the A. S. A. Comm. 21, reported that specifications where these result from the activity of joint committees with other associations.

Following considerable discussion from the floor, including a passioned plea for the NEWWA not to commit suicide by David Moulton, Atty. for the Portland Water District, it was voted to table indefinitely any consideration of a proposal that the NEWWA join with the A. W. W. A. in forming one unified North American Water Works Assn. A motion then on the floor to appoint a special committee to study the idea was killed in consequence.

AWWA's Prexy and First Lady, The Wendell La Dues, flew in from Akron, O.

"Doc" (Bull Thrower) Symons, Assoc. Ed., W. & S. Wks., and "Ginny" S.

"Wally" Miller, Water Supt., Ossining, N. Y., and Mrs. "Wally"

Ladies' Prize Winner! Mrs. Ed Rothman, Bridgeport, Conn.

The "Bill" Eastburns (Math. Alkali) Providence, R. I.

"Rollie" Leveque (Omega's Sales Mgr.), Providence, and Mrs. "Rollie"

The Hugo Bergmans (W. & T. Co.), Boston, Mass.

At the Wednesday Night Costume Party

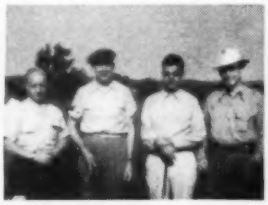
Springfield's Transmission Mains

In discussing the "Additions to Springfield's Transmission Mains," **Peter C. Karalekas,** Chief Water Engineer, Springfield, Mass., first gave a brief description of the system. The original lines constructed in 1909 consisted of 39,000 ft. of 42-in. from filters to Provin Mt. Reservoir, and 24,100 ft. of 42-in. from Provin Mtn. to the city. In 1928, 33,000 ft. of 54 and 48-in. line was constructed from Provin Mt. to the city to increase the supply. In 1943, 13,000 of 51 and 58-in. line were constructed from the filters to the first cross connection. Tests on the lines recently have indicated that the flow coefficient has decreased approximately one "C" unit each year and the estimated capacity of the single 42-in. main from the filters is but 24 mgd. Consumption has now reached more than 22 mgd., with a maximum demand of 44 mgd.

To offset this narrowing differential between capacity and consumption, plans were made in 1942 to construct a 52-in. steel pipe for the entions are under consideration for DeLevaud sand spun and tar dipped pipe. Pressure ratings are under revision, as are those concerned with the curing of cement linings.

The Committee on Threads for underground fittings plans to have a final report next year, according to W. W. Brush, Chairman. The new Committee on Specifications for Joint Committees has been set up to systematize the process of issuing speci-

Dresser's "Dan" Atwell and John Atwell (Dan's dad) of A. P. Smith Co., with "Gerry" Manahan, Sales Mgr., A. P. Smith Mfg. Co.



H. H. Draper (E. & F. King Co.), Jim Morley (Pittsbg.-Des Moines Steel Co.), "Art" Burke (E. & F. King Co.), "Hap" Ford (Eastern Mgr., Pittsbg.-Des Moines Steel Co.)

The fourth green with the water hole beyond through the trees.

"Al" Paxton (E. N. Record); "Ed" Phoenix (Johns-Manville); Jim Ballard (E. N. Record); "Bob" Orth (Johns-Manville), all of New York

"Jo" Gilbert (Link-Belt Co.'s manager of sanitary sales) and "Bill" Eastburn (recently appointed New England manager for Mathieson Alkali)

On the Golf Course

Frank J. Callahan, Gen. Supt., New Haven (Conn.) Water Co., and Mrs. Callahan

Fred Gibbs, N. E. Mgr. Wallace & Tiernan Co. and Mrs. Gibbs Boston

N. C. Smith, Dist. Mgr. Ludlow Valve Co. and Mrs. Smith New York

Mrs. Francis L. Hatch and Mrs. Elmer J. Burnham Kittery, Me.

Victor Bengle, Mgr., W. & S. Div., Chapman Valve Mfg. Co., and Mrs. Bengle Indian Orchard, Mass.

On the Veranda

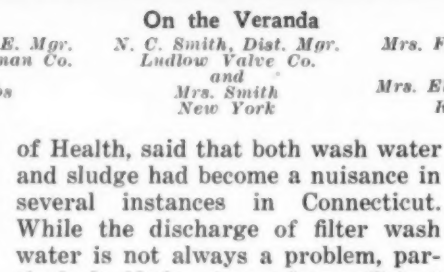
tire 39,000 ft. from the filters to Provin Mt. During the war this size pipe was not available so the pipe was refabricated out of 26 and 36-in. sizes obtained from various unused yard stocks in the country. By splitting these pipes, unrolling them on special machines, and then rerolling and welding, the new size was obtained for 13,000 ft. of the line. The pipe cost $26.27 per ft. as compared with lower estimates for the original 52-in. pipe. Federal funds under the Lanham Act aided in defraying the total cost of $621,-365.99.

Thirty foot lengths were fabricated, and all sections were tar dipped, whitewashed, shipped to the site, where they were laid for $159,-000. Mr. Karalekas described the construction difficulties. This section of 13,000 ft. increased the capacity of the 42-in. line by 25 per cent. Even this increased capacity would not meet the peak demands on the system.

Plans are now drawn for completing the 26,000 ft. section of the second transmission main. Forty-eight inch welded steel pipe will be used. The bid to complete the work was $849,052. The pipe will be fabricated in 34 ft. sections and will be coated. Completion of this transmission main will increase the capacity from 30 to 75 mgd.

Sludge Disposal From Water Plants

In a paper on "Problems in Disposal of Sludge and Wash Water for Connecticut Water Filtration Plants," **Frederick O. A. Almquist,** Prin. San. Engr., Conn. State Dept. of Health, said that both wash water and sludge had become a nuisance in several instances in Connecticut. While the discharge of filter wash water is not always a problem, particularly if the stream has sufficient flow, the discharge of sludge from basin cleaning operations frequently results in nuisance conditions because of the high biochemical oxygen demand of the material. In the past little thought has been given to these problems in the designing of a water plant, and there is little information in the literature on the subject.



Celebrating Their 25th Convention
The Roger Estys of Danvers, Mass. The Charlie Crumps of Franklin, Mass. (Esty is Supt. of the Water & Sewer Board of Danvers and Crump is Franklin's Super)

Analyses of samples of sludge from 13 plants shows the sludge to have an average moisture content of 98.7 per cent, with a range from 95.8 to 99.95 per cent. Ash content ran from 27 to 67 with an average of 46 per cent. The B.O.D. varied from 38 to 1100 and averaged 337 ppm. The oxygen consumed value ran from 270 to 13,-000 and averaged 4700 ppm. Average pH was 6.1 and the mineral content showed Aluminum 25.1 per cent, Iron 3.2 per cent, Silica 9.6 per cent, Calcium 0.7 per cent. (All of the 13 plants used aluminum sulfate coagulant.) Brown or black in color, the sludge had a disagreeable odor of sour decayed vegetable matter. In some cases it had a distinct hydrogen sulfide odor. Bacterial content varied from 1700 to 2,700,000 per ml. and in nine samples no coliform organisms were found.

Mr. Almquist said that sedimentation basins were cleaned from one to four times a year, and eight plants have had complaints. Generally, the more often the basins are cleaned the less likely are complaints. In five of the plants studied, detailed descriptions of the problems show that location and design of the plants have considerable bearing on the extent of the nuisance problem. Eleven other plants are close enough to large streams to obtain necessary dilution and far enough from permanent habitation so that no complaints have been received by the Conn. Dept. of Health.

As to possible remedies, Mr. Almquist suggests the following:

1. Discharge of sludge and wash water into public sewer systems.
2. Discharge into streams with sufficient dilution to handle the load.
3. Treat the sludge on sludge drying beds or by other methods.
4. Add chemicals to the sludge to reduce its odor and nuisance.
5. Lagoon the sludge and wash water.
6. Lagoon sludge and provide for decanting water by floating weir.
7. Pump sludge and wash water up to head of raw water reservoir supply.

Reg. Hayes, chmn. of golf tournament, at score sheet. Looking on is Mueller's Roy Evans, and Jimmie Williamson—and who else?

The J-M transite pipe demonstration. Chas. W. Easter, supt. at Claremont, N. H., gets the answers from Dale Crosby and Ed Faenza of J-M.

At the first tee. W. R. La Due, Pres., AWWA (center), Hersey Meter's "Bob" Fergusson and a fellow with his back to the camera

"Al" Lash, Geo. A. Caldwell Co.'s president, learning from Roger Esty how it's done—two birdies in a row.

Ray Parkhurst, Rensselaer's sales manager, on the 15th green.

All of these suggestions should, according to Mr. Almquist, be subject to further study and evaluation. For example, the effect of sudden discharges of this type of sludge on sewage sludge digestion tanks is not known; the aluminum content might be deleterious. For various reasons other suggested remedies will need study, too.

More Costumers

The Reg. Hayes (Sales Mgr., Hydrotite) New York

The Ed Rothmans (W. & T. Co.) Bridgeport, Conn.

May Diven Jackson Heights, L. I.

The Fred Gibbs (W. & T. Co.) Boston, Mass.

The Lindy Harpers (Omega Pres.) Chicago, Ill.

Free Residual Chlorination

Marshall S. Wellington, Sanitary Engineer, New Haven Water Co., New Haven, Conn., presented a paper entitled "Experiences of the New Haven Water with Free Residual Chlorination," and thereby became the first person to adopt the new chlorination terminology in the presentation of a formal paper.

Free residual chlorination (once called break-point chlorination) was introduced at New Haven in 1944. The dosage was determined by laboratory tests, with the flash residual being 85 per cent of the total after one hour contact. At low chlorine dosage rates, disagreeable odors were either disclosed or intensified. At higher dosage rates, with a free available chlorine residual, only a slight chlorinous taste was noticeable; at still higher dosage rates a chlorinous plus metallic taste was noted.

In eight supplies of the city, chlorine dosage before free residual chlorination varied from 0.47 to 1.38 ppm. and residual chlorine produced varied from 0.11 to 0.38 ppm. Under those conditions (combined residual chlorination) the percentage of positive tubes in the treated water varied from 34 to 72, while the per cent of positive tubes in the raw waters varied from 32 to 92. Obviously chlorination as formerly practiced had produced little improvement in the bacteriological condition of the water.

Entertainment Chairman
Reg. Hayes Sales Mgr. Hydraulic Devel. Corp. New York

Ass't Secretary
Alice Melrose of NEWWA Headquarters

When free residual chlorination was introduced the chlorine dosage was upped to between 1.0 and 2.2 ppm. The residual was upped, thereby, to between 0.39 to 0.93 ppm. Under these conditions of free available chlorine residual the percentage of positive tubes in the treated water was only from 5 to 12 (except in two cases where short contact time was responsible for the positive tubes being reduced to only 36 or 43 per cent). At the same time the number of positive tubes in the raw water ran from 40 to 85 per cent. Thus, these data proved the effectiveness of free residual chlorination in improving the bacteriological condition of the water throughout the distribution system.

Mr. Wellington observed that if the contact time were only ten minutes, the best results were obtained when the flash residual and the five minute residual were the same. If the contact time is one hour, the flash residual can be but 85 per cent of the total five minute residual. Free residual chlorination is effective in removing odors of Asterionella, Uroglena and Dinobryon. Some tastes were accentuated when the method of chlorination was changed from combined residual chlorination to free residual chlorination.

Under the proper conditions of sampling, the presumptive test acquires greater value for control purposes because gas formers may be used as a guide to free residual chlorination.

Corrosiveness of Water to Metals

In "Part II—Practical Applications of the Theory," **Thomas R. Camp** continued his presentation of information on the "Corrosiveness of Water to Metals." Mr. Camp, former professor of Sanitary Engineering at M. I. T. and now a Consulting Engineer of Boston, published Part I of his contribution to the "Theory of Corrosion" in the June 1946 issue of the Journal of the NEWWA.

In Part I of the paper Mr. Camp showed that all of the reactions in the corrosion of metals in contact with water, including those resulting

The Jack Divens (Leadite) Jackson Heights, L. I.

The Tom Lawrences (Supt.) Groton, Mass.

The Horace Clarks (Cons. Engr.) Sanford, Me.

The Don Calderwoods (Supt.) Nashua, N. H.

The Fred Almquists (San. Engr.) Hartford, Conn.

Art Burke (E. & F. King) Augusta, Me. Earl Tarr, Supt., Winthrop, Me.

The Roger Estys (Supt.) Danvers, Mass.

(The prize-winning couple—the Don Calderwoods. We regret the accident to the film, and hence the very poor results in this strip.)

Programmers

Warren J. Scott, Hartford, Conn. — *L. W. Trager, Concord, N. H.* — *Walter J. Shea, Providence, R. I.* — *Arthur D. Weston, Boston, Mass.*

(All Chief Engineers of State Health Departments.)

in solid corrosion products, can be explained in terms of half-cell reactions accompanied by the flow of electric current. In Part II Mr. Camp gives some pointers and suggestions in the practical application of the theory.

A study of the reactions in corrosion by water indicates the importance of changes in pH value, and the relative importance of dissolved constituents in water in reference to the corrosion of iron, lead, copper and brass.

In the principal anodic reactions of iron, it has been found that the solution of metallic iron may be prevented if the water contains a sufficient concentration of hydroxyl, carbonate, or phosphate and that the corresponding reactions will produce a solid coating consisting respectively of ferrous hydroxide, ferrous carbonate, or ferrous phosphate. Corrosion will proceed until the solid coating completely covers the metallic iron, after which corrosion must stop unless the coating itself can take part in another anodic reaction. Therefore, with favorable constituents in the water, the corrosion of iron may be inhibited by anodic protection alone. Thus, the solution of iron may be prevented if the pH is raised above 8 or 9 and the water contains a relatively high bicarbonate alkalinity. For instance, at 8.3 pH a bicarbonate alkalinity of not less than 46 is desirable. (Use of soda ash to raise pH and use of calcium carbonate equilibrium are common treatments that fit into this theoretical picture.)

While it is common to explain that a film of calcium carbonate serves as a protective coating, such is not the case because calcium carbonate deposits are usually too porous to prevent penetration of water through the coating. A better explanation is that the presence of solid calcium carbonate requires the simultaneous presence of an appreciable quantity of carbonate ion in solution, and if the concentration of this carbonate ion is sufficient and the pH in the pores of the coating and at the metal surface is high enough, then protection is effective for that reason, notwithstanding the nature of the coating.

W. R. La Due, Supt. & Engr., Dept. W. & S., Akron, O. (Pres. AWWA) — *Karl Kennison, Chief Engr., Water Sup. Comm., Boston (Past Pres., NEWWA)*

The addition of lime or sodium hydroxide to raise the pH value to 9.5 or 10.0 likewise will prevent corrosion after the production of ferrous hydroxide at the anode surface. Mr. Camp did not have any data on the reaction in which phosphates are used for protection, but he postulates that its protection derives in the same manner as that which comes from carbonate ions, and is likewise dependent on pH.

Where cathodic reactions, rather than anodic reactions, are concerned in the corrosion of iron, Mr. Camp says, that contrary to popular belief the corrosion with the release of free hydrogen does not take place unless the pH is 2.0 or below and does not apply in corrosion by natural or purified waters. All other cathodic reactions which are of significance, in the absence of chlorine, require dissolved oxygen. The rate at which these reactions go depends on the concentration of dissolved oxygen, but it is not sound economy to practice de-oxygenation in municipal water treatment. Chlorine being a stronger oxidizing agent than oxygen will increase the overall potential which causes corrosion.

From Mr. Camp's discussion it was evident that corrective treatment of water for protection against corrosion of iron may be aimed at retardation of either anodic reactions or cathodic reactions or both. Protection at the anode is more practical for municipal water supplies inasmuch as it retards the solution of iron. Most municipal water supplies are chlorinated and therefore protection at the cathode will be ineffective.

For the corrective treatment of the relatively soft waters, such as the New England waters, to prevent corrosion of lead a pH range between 8 and 10 is required, along with an adequate carbonate and bicarbonate alkalinity. Raising the pH value is of itself an ineffective corrective for lead attack, in that it may actually *cause* the solution of lead at the anode as bi-plumbate ion. An adequate quantity of carbonate (CO_3) ion is of first importance in the protection of lead.

From consideration of the theory, it is evident that corrective treatment is not required for the protection of copper under ordinary conditions if the pH is above 7.0, but if ammonia is present the pH must be raised above 8.0 or 9.0 to prevent the solution of copper at the anode.

Corrective treatment of water for

Programmers

T. R. Camp, Cons. Engr., Boston — *Fred Almquist, San. Engr., Hartford, Conn.* — *Wm. Storrie, Cons. Engr., Toronto* — *Allen Symonds*, Supt., Millbury, Mass.*

*(*Chairman of Superintendents' Round-Table.)*

Ed Case, Pres.
Pitometer Co.
and
Mrs. Case
New York

Tom Lawrence, Supt.
Groton Water Co.
and
Mrs. Lawrence
Groton, Mass.

Wm. J. Orchard, Gen. Mgr.
Wallace & Tiernan Co.
and
Mrs. Orchard
Newark, N. J.

Walter Hersey, Pres.
Hersey Meter Mfg. Co.
and
Mrs. Hersey
Boston

B. E. Frisby, Trustee
Kittery Water Distr.
and
Mrs. Frisby
Kittery, Me.

the protection of brass against corrosion involves the raising of the pH sufficiently to produce zinc hydroxide at the anode and thereby prevent dezincification. pH values above 7.0 are reasonably effective but the higher the pH value the more effective is the treatment.

Mr. Camp closed with the hope that his paper will lead to more effective treatment of water for the control of corrosion.

Linn H. Enslow felt that the advocating of such high pH values for soft waters was not in the best interest of the water works profession. He advocated the introduction of calcium carbonate and a pH value not much above 8.2 as the most overall practical treatment for the protection of the commonly used metals.

Okinawa Water Treatment Plants

By means of illustrating slides, **E. W. Campbell,** Director, Division of Sanitary Engineering, State Department of Health and Welfare, Augusta, Me., gave the audience an excellent idea of the problems confronting the army in procuring water on the island of Okinawa. As in the case of any invasion in the Pacific area, the first water supplies were usually from distillation units. Camouflage of water points, construction of underground supplies, and construction of permanent supplies were shown and described.

Cement Linings for C. I. Pipe

A paper on "Cement Linings for Cast Iron Pipe," prepared by **Thos. F. Wolfe,** Research Engineer, Cast Iron Pipe Research Assn., Chicago, was read by **H. Lloyd Nelson,** Eastern Mgr. of the U. S. Pipe and Foundry Co., Philadelphia, Pa.

Beginning with the introduction of tar-dipping in 1854, Mr. Wolfe's paper traced the history of pipe lining for protection, ending with the modern development of cement coated cast iron pipe. Whereas pinhole tuberculation was the worst difficulty in tar dipped pipe, the joints were the bothersome problem in the first attempts at cement lining. Now, however, it is possible to obtain bell and spigot pipe coated with cement.

Manufacturers' Association

(President)
W. Sherwood, V.P.
Hersey Mfg. Co.
Boston

(Secy. & Mgr.)
Arthur L. Clark
W. & S. W. M. A.
New York

The first attempts to line cast iron pipe with cement were made with a mandrel to squeeze the cement against the pipe surface with the pipes standing on end. Next came the centrifugal process, and lastly the extrusion method with greater production. Cement lined pipe may be easily tapped; it prevents turbidity in water; it will mitigate taste and odor troubles and red water, and will not be injured by cutting. Its greatest value, however, lies in the maintenance of smooth walls and high "C" values. Whereas in ordinary tar dipped pipe the "C" value may drop from 100 to 70 to 52 to 40 in 10, 20 and 30 years, respectively, case histories indicate that cement lined pipes which have a "C" value of 130 at installation will still have a "C" value of 121 at the end of ten years of service on corrosive waters.

After 23 years, it has been found that a 30-in. cement lined pipe is delivering more water for less cost than a 36-in. cast iron pipe. Where pumping is involved a high "C" value not only results in lower operating costs, but it will be possible to use a smaller diameter pipe in the original installation because one can count upon but little loss of "C" value during the long life of cast iron mains. Smaller pipe is less costly to install, so both installation and operation costs are reduced.

Water Works Extensions of Toronto

"Toronto's Water Works Extensions" were described by William Storrie of Gore, Nasmith & Storrie, Engrs. of Toronto. Included were the new intake and the new Victoria Park Pumping Station and Filtration Plant. Connecting the new pumping station with the older John St. Station was constructed a 7 ft. diameter purified water tunnel for operation in either direction. The existing plants (pumping and filtration) located on Center Island are eventually to be abandoned inasmuch as the new intake secures much cleaner water because of its projection well offshore (3,300 ft.) opposite

Walter Shea, Chief Engr.
R. I. Dept. of Health
and
Jim Turner, Supt.
East Providence, R. I.

Wm. Naylor, Supt.
Maynard, Mass.
and
A. H. McDonald, Supt.
Littleton, Mass.

Mrs. Hugo Bergman
Boston
and
Mrs. Wm. End
Troy, N. Y.

Thos. E. Kennedy, Supt.
Fitchburg, Mass.
and
Robt. W. Glasheen, Supt.
Athol, Mass.

Thos. L. Camp, Cons. Engr.
Boston, Mass.
and
"Ted" W. Grindle, Mgr.
Bar Harbor (Me.) Wtr. Co.

the area of least drainage from the city into Lake Ontario and the favorable lake currents for the purest and coldest water taken at a depth 50 ft. beneath surface.

Mr. Storrie described how lake ice is piled up near the shore line 25 ft. high and the need for 110 ft. deep tunnel construction of 10 ft. diameter in shale formation for 3,300 ft. of the intake. The next 4,100 ft. of intake is of 100 ft. lengths of germite protected steel lined concrete 8 ft. diameter conduit, each length weighing 250 tons. The jointing is of interesting bolted flange design of ¾ in. plate, which is later encased in concrete in the trench on lake bottom. Eventually there will be two more of these 8 ft. diameter intakes, forming a fan out into the lake.

At the end of the line there is a unique intake structure 20 ft. in diameter, divided into eight sections by vertical baffle plates, providing eight rectangular openings arranged in a circle and taking water in at the 50 ft. depth from the side.

At the Victoria Park Pumping Station the intake shaft is provided with four traveling screens each in a separate compartment, subject to isolation from the rest. The pump motor sets in the station all exceeded their guaranteed efficiencies by the suppliers and won for them the earned premium.

The new Victoria Park Filter Plant designed for ultimate capacity of 200 mgd. (Imperial) at standard rate of 105 mgd. per acre of filter area is at present equipped with 20 filters in facing rows of 10, producing at a 100 mgd. rate and located on top of a 12 mg. clear water reservoir. The underdrain system is of the lateral and orifice design with one ¾ in. orifice for each square foot of filter area. The orifices are brass nozzles pointed down. The laterals are tied together as a grid system to obtain pressure equalization during washing. The filter sand, to depth of 26 in. over an 18 in. gravel bed, is of 0.55 mm. effective size with a 1.5 uniformity coefficient. The design for chlorination had especial attention, providing for rapid mix super-chlorination and later dichlorination of the filtered water with sulfur dioxide as it leaves the plant, after the adequate chlorine contact period in the 12 mg. filtered water reservoir. This process has long been used in Toronto at the Center Island Plant and represents the earliest and oldest large scale super and dichlorination practice in the world.

Alum is used for coagulation in the specially designed "Gore Mixing Tanks," developed by the late Wm. Gore of Mr. Storrie's firm for the Ottawa Filtration Plant and since of proven worth also for the Toronto water as well as elsewhere. At maximum plant output (100 mgd.) the mixing period is 40 min., followed by 2 hr. and 50 min. theoretical settling period ahead of the filters. Each mixing chamber is 90 ft. wide and 73 ft. long divided into 12 separate compartments, the water changing direction of spiral upward or downward flow upon passage from one to the next compartment. The total head loss through the chamber is only about 4 in. at normal capacity. The alum dosage averages 0.5 grain per gal. and rises to a maximum of only 1.5 grains for brief periods.

Mr. Gore stated that with the 36 mgd. slow-sand plant and the 60 mgd. drifting sand plant on Center Island plus the new 100 mgd. plant, the total capacity of 196 mgd. (Imperial) of purified water is considerably in excess of requirements, permitting great flexibility in plant operations.

Toronto maintains a separate high pressure (up to 300 psi. residual pressure) fire supply grid in the congested sections, consisting of 10 miles of mains and 173 hydrants supplied by steam turbine driven pumps having 20 mgd. combined capacity. The system is fed with harbor water and 100 psi. pressure is maintained continuously, there being no interconnections between this and the potable water system.

(Note: As a tribute to the late R. C. Harris, for 33 years Commissioner of Works for Toronto, the new Victoria Park Works has been changed in name recently to "The R. C. Harris Water Purification and Pumping Plant.")

Stream Pollution Abatement in New England

Under the caption, "Problems and Progress in Handling Stream Pollution Abatement in the New England States," a brief presentation of this topic for his respective State was made by each of the Chief Engineers of the State Health Depts. of the six New England States.

Warren J. Scott stated that in Connecticut the control of pollution is the job of two agencies—the State Health Dept. and the State Water Commission, the latter being charged with the handling of pollution by industry and the Health Dept. concerning itself principally with sewage disposal. However, new sewage treatment plants and plant alterations must be reviewed and approved by both agencies working closely together.

Since 1925 no new industrial pollution has been permitted without authority of the Water Commission. The Commission can direct any polluter to provide treatment of water but must in each case specify the means of treatment, which must also prove equitable and not prohibitive. Also the Interstate Sanitation Commission has jurisdiction over the Southwestern area of Connecticut up to and inclusive of the New Haven Harbor. However, no abatement order can be issued in Connecticut without approval of the three Connecticut members on the Commission, followed by a 6 month period of opportunity of the pollution to correct conditions before an order can be issued. This Commission has been effective in securing abatement in its area of activity.

Mr. Scott cited marked improvement in the abatement of municipal pollution throughout the State, improved plant operation and the effectiveness of the Plant Operator Qualifications Act administered by the Dept. of Health. Progress is noted in the recent approval of plans for nine new treatment plants and the 15 communities with plans and specifications for plants now under way. In the industrial waste field the Conn. Water Commission continues to carry on research and treatment studies, and improvements have resulted. The Commission and the Health Dept. are working cooperatively in stream surveys and classification of streams in order to determine minimum degree of treatment in each location according to the highest use of the stream or other body of water involved.

Mr. Scott said that the Federally-guided compact method of handling intra-state pollution was preferable to too much direct Federal jurisdiction but straightforwardly warned that the individual States must act promptly and assume responsibilities if Federal control to an undesirable extent is to be avoided.

J. Elliott Hale, Tech. Secy., Sanitary Water Board of Maine, revealed that this Board was created in 1941 for the purpose of securing pollution abatement. In 1945 the law was amended requiring all new industries in Maine to be licensed to discharge wastes into streams, licenses being subject to revocation. Existing industries are not required to make corrections of any then existing pollution. With a mobile laboratory, stream classification is under way, employing the same pattern of A, B, C, D classification adopted by the New England Con-

Henry F. Hughes
Supt.
Medford, Mass.

Arthur Faneuf
Asst. Supt.
Concord, N. H.

Carter Lamb, V.P.
Jamaica (L. I.)
Water Co.

R. Blanchard, V.P.
Neptune Meters
New York

Richard Hazen
Cons. Engr.
New York

E. T. McDowell
Supt.
Biddeford, Me.

Roger Esty
Supt.
Danvers, Mass.

ference of State Sanitary Engineers during 1945.

Taking our river basin as the "guinea pig," the securing of equitable pollution abatement has met with reasonable success. The appropriation for the pollution control work is only $10,000 per year, so the organization is not extensive. The law permits of interstate cooperative attack and also Federal cooperation, which is welcomed.

Mr. Hale gave details concerning the 6,000 miles of streams surveyed to date in Maine and indicated the acceptability and adequacy of simple treatment of wastes and sewages in the major instances of pollution of shore waters as well as streams, his motto being a "bite at a time," and equitable requirements for all polluters regardless of faith, creed or politics.

Leonard W. Trager, State Sanitary Engr. of New Hampshire, stated that the Water Pollution Board of N. H. had recently been established and has a mobile laboratory at work concentrating on a study of one river basin with 12 communities therein. The 10-member board has evolved the policy of cooperation with neighboring states and the Federal government; the classification of waters first, and specifications for minimum treatment in the light of the highest use and potential highest future use of the streams studied.

Edward L. Tracy, State Sanitary Engr. of Vermont, reported the holding of many river basin meetings to discuss the need for a pollution law and corrections. A legislative committee is now drafting a law which will entail a "Sewer Service Charge Enabling Act." At present only 6 per cent of Vermont's serviced population is served by treatment plants as compared to 59 per cent for the nation at large. Plans for Burlington, Brattleboro and other cities are under way and no opposition to the "Sewer Service Charge Act" has been registered to date.

Walter J. Shea, State Sanitary Engr. for Rhode Island, stated that since 1939 a pollution law has been administered by the State Health Dept. Since 1939 three treatment plants in Rhode Island have grown to 10 plants and thus 90 per cent of the serviced population are served by treatment plants. As to industrial wastes, little had been accomplished and securing voluntary joint action by small municipalities that might finance a joint treatment works had been impossible to date. What is needed are district projects to serve the smaller communities which are jointly financed; an adequate Sewer Service Charge Act; industrial waste treatment "know-how," and Federal aid in financing treatment works, domestic or industrial.

Arthur D. Weston, Chief Engr., Mass. Dept. of Health, briefly described the recent Mass. anti-pollution law of Sept. 1945 (Chapter 615, Acts of 1945), is administered by the Mass. Dept. of Health, which has drawn rules and regulations prohibiting discharge of any putrescible wastes of any nature into any body of water when such discharge tends to create a health hazard or a nuisance unless approved first by the State Dept. of Health. Already under this Act four municipalities and more industrial polluters have been referred to the Attorney General. In the matter of stream classifications, Mr. Weston demonstrated from actual facts and figures, uncovered in stream studies, that not sufficient emphasis has been placed on bacterial quality and probably oxygen demand has been too generally relied upon in classification. He cited the following supporting evidence.

Stream "A" had a B.O.D. of only 4.33 ppm., but the coli count ran up to 100,000 per c.c. as against the index of only 1,000 for bathing waters.

Stream "B," although considered very free of pollution, revealed a coli index of 10,000 at times. Only requirement to meet standard of a Class "A" or "B" stream is sewage effluent chlorination.

Stream "C" underwent a 5 year study. The head station revealed B.O.D. of 2.9 and 2460 coli index. At mid-station (18½ mi. down) the B.O.D. reached 13.9 and coli index 65,000 as average. Down farther (25 mi. lower) the B.O.D. had returned to 3.9 and coli index down to 2240. This stream had recovered from a 425,000 pop. load of sewage and wastes, but indicated need for some degree of sewage treatment.

Stream "D" (an interstate stream) revealed a coli increase while B.O.D. reduced to 1.5 ppm., thus indicating sewage effluent chlorination as the corrective.

Stream "E" revealed that the coli index was satisfactory only because an industrial waste entering had produced partial sterilization and a slowing down of the oxygen demand rate.

Stream "F" jumped from a B.O.D. of 1.20 to 5.6 accompanied by a coli index of 836 jumping to 126,000,

Thos. Lawrence
Supt.
Groton, Mass.

Phil Holton, Jr.
Supt.
Providence, R. I.

Ralph Kelley
Northrop & Co.
New York

*Joe Lufkin**
Red Hed Mfg. Co.

**Special Note—Joe Lufkin, veteran salesman, was attending his 55th consecutive annual meeting of NEWWA. Isn't this a national record?*

which sewage chlorination would have corrected.

Stream "G," thought to be the world's most polluted stream, revealed a B.O.D. of 787 with extremes of 1420. On this stream remedial measures under way constitutes one of the first orders of business under the new Act.

Mr. Weston commented that Federal legislation is not the solution but that research at the Federal level will be most helpful. He advocates interstate compacts and Federal assistance when needed. And, for Massachusetts, with the new law he expects to realize marked progress over the ensuing three years.

A Resolution

At the close of the session on Stream Pollution Abatement Progress, a resolution was offered to the effect that the several associations interested in a Federal anti-pollution law which would not contain objectionable features to the state and municipal authorities should establish a joint committee to draft a new bill for consideration by the new Congress. It was voted that the NEWWA join with the New England Sewage Works Assn. in appointing a representative to such a committee.

[Ed. Note—Since this action the matter has been considered by the Federation of Sewage Works Associations and the Am. Water Works Assn., but neither feel that such a committee can be justified on practical grounds and no action was taken by either association to join in the proposal.]

Reforestation Practice

In a very thorough and detailed paper Russell Snow, Forester of the Metropolitan District Water Supply Commission, presented experiences in conducting a large scale reforestation project in which 10,000,000 young trees have been planted on 9,000 acres of Quabbin Reservoir watershed in a plan calling for 3,000,000 plantings per year. The project, started in 1934, involved the construction of three nurseries to raise 4 yr. old transplants from seed.

Mr. Snow's paper goes into considerable detail from gathering seed of coniferous trees, the germination tests, construction and preparation of seed beds, sterilization of beds, transfer of seedlings, spraying against insect attack and disease, transplanting, and finally planting. The favored trees are white and red pine, red spruce, hemlock and Norway spruce. We can't do this paper justice in this report, and neither could Mr. Snow in the time allotted which was over-run, and discussion was precluded thereby.

Superintendents' Round Table

Under the chairmanship of **Allen Symonds**, Division Mgr., Water Utilities Service Corp., Milbury, Mass., the superintendents' round table considered the **"Cost of Installation of New Mains in Private Ways, and New Developments,"** and **"Steps Taken to Protect Water Systems from Being Depleted During Periods of Heavy Draft in Dry Weather."**

On the first question, that of who pays for new mains in new developments, **Roger Oakman,** Supt., Needham, Mass., said that although he feels that 100 per cent is a little steep, his community makes the developer put in everything and pay for the entire cost of the mains.

Walter C. Conroy, Supt., Belmont, Mass., said that in his community 25 miles of main were laid in developments between 1909 and 1926, and 29 miles since that time. The trend has been to charge 75 per cent of the cost of the mains to the developer.

Warren Scott, of the Conn. Dept. of Health, asked if a developer can put in a water plant of his own, to which Roger Oakman replied that the planning law required the developer to put in the pipe but the town controls its own affairs. Where a private firm has a charter, said Allen Symonds, others cannot sell water.

When **Tom Camp** asked the question about public money financing private property and its effect on slowing up development, **Harold Griswold** said he didn't believe that private property should receive any public money, and **Roger Oakman** added that slowing up of such developments is desirable as a rule.

Roswell Roper, Supt., East Orange, N. J., says a ten year contract for repayment of the cost of the mains from water consumers works very well. **W. W. Brush,** New York City, said that the question should be settled on a sound basis that should pay for construction and amortization; and he suggested a committee be appointed to study the allocation of costs of mains in developments.

Among the other phases of the subject covered were the question of what to do if the distribution system feeding the development had practically reached its capacity (strengthen it, by the city); whether the developer should install the mains (no, the city should do it and supervise backfilling by developer); and how much return is necessary on the line (10 per cent per year may be enough, 15 per cent is better, or divide the total cost among customers in a manner to recover the cost during a period of five years).

A motion was passed to appoint a committee to investigate and report on factors that should be investigated by municipalities and private companies in setting up charges that will meet the cost of such extensions—(Only the factors to be considered, not the amounts, are to be reported on by the committee.)

Little time was left in the session for a discussion of the effects of heavy dry season drafts on water supplies, but **Roger Oakman** told how his department had to request consumers to stop sprinkling and how it was effective. Harold Griswold, retiring president, voiced the opinion that "Dry periods are sent by Providence to convince the people and to give a superintendent an argument to present to his board to strengthen the system so as to give everyone all the water they want."

Don Calderwood, Supt., Nashua, N. H., told of a unique experience in his community: not that the water supply was running low, but how the operators had to answer many telephone calls to explain that the water supply was *not* running low. It seems the village across the river was running out of water and hired loud speaker trucks to explain the depleted water supply to its consumers. The loud speakers carried across the river to Nashua and, of course, many citizens rushed immediately to call the Nashua office about the pending calamity.

Twenty-Five Year Certificates

Twenty-five year certificates were presented to members who had served their communities for that period of time. Among those so honored were the following:

Dennis P. Sullivan, Supt.
Malden, Mass.

James G. Gibson, Supt.
Charleston, S. C.

Henry F. Hughes, Supt.
Medford, Mass.

Chas. Loxby, Supt.
Williamstown, Mass.

Roger W. Esty, Supt.
Danvers, Mass.

Entertainment

In addition to two cocktail hours before dinners, a costume ball, a putting contest and a golf tournament, three motion pictures were shown at the technical sessions. These were "Clean Waters," the General Electric Co. film on stream pollution; "Concrete Facts," the picture of the Master Builders Co., Cleveland, O.; and the Cast Iron Pipe Research Assn. motion picture on "Installing Cast Iron Pipe."

Prize winners of the various contests as announced by Chairman of the Entertainment Comm., Reg Hayes, were as follows:

Golf—Low Gross—Active Member, R. E. Murphy; Assoc. Member, Winthrop Hersey.

Kickers Handicap—Active Members, Gerald Bolton, James V. Turner, Peter Karalekas, J. J. Sampson; Assoc. Members, Ray Parkhurst, H. H. Draper.

Putting Contest — Ladies, Mrs. Karl M. Mann; Men, Julian McKensie.

Costume Party—Ladies, Mrs. Ed. Rothman; Men, Don Calderwood.

$17,000,000 Clean Up Program by Indiana Industries Polluting Lake Michigan

$10,000,000 in Contracts for Abatement Already Signed

At long last the south end of Lake Michigan is to be cleaned up of its industrial pollution load which has been so detrimental to the water supply of Chicago, Hammond, Whiting and other cities. The clean-up which is now going forward rapidly is the result of the suit brought by Ilinois against the Indiana cities of Whiting, Hammond, East Chicago, Gary, and 20 industrial corporations known to be major polluters.

The following represents the present status of the clean-up program estimated to cost the defendant municipalities and corporations $17,000,000 for abatement facilities and treatment plants. Of this amount contracts representing $10,000,000 for ameliorating procedures and treatment facilities have been signed by the several municipalities and industries. Already the total pollution had been reduced by about 30 per cent through the trial of cooperative procedure before the court action had to be resorted to.

Hammond.

City sewage treatment plant completed and working 100 per cent.

American Maize Products Co.—$750,000 plant to treat industrial waste 75 per cent completed. Sanitary sewage piped into Hammond sewage plant.

Whiting.

Two-thirds of Hammond sewage, formerly dumped into lake, is being sent through Hammond plant.

Other third to be similarly treated as soon as connecting sewers can be completed. Work now under way.

Carbide & Chemical Corp.—All sanitary sewage piped into Whiting sewer system and thence into Hammond plant. Industrial waste plant, to cost $500,000, is 50 per cent completed with work on it continuing.

Standard Oil Co. of Indiana—Working on $4,000,000 system. Company is turning all sanitary sewage into Whiting sewers, to be treated in Hammond. Work on oil separating system under way, and 25 per cent completed.

Gary.

Sewage plant completed and in excellent shape to care for all corporations in its limits.

American Bridge Co.—Has connected sanitary sewers to Gary plant.

National Tube Co.—A war plant which may be discontinued. However, should it continue to operate, it has agreed to connect with Gary's sewage system.

Universal Atlas Cement Co.—Completing own sewage disposal plant.

Carnegie Illinois Steel Co. — This plant of 24,000 has agreed to install a complete sewer system and connect with Gary plant at an expense of $3,000,000. Work is 25 per cent completed.

East Chicago.

Sewage plant completed and working satisfactorily.

Bates Expanded Steel Co.—Has connected sewers with the East Chicago plant.

Cities Service Oil Co.—Has connected sewers with East Chicago sewer disposal plant and is building oil separator plant, which is 20 per cent complete.

Cudahy Packing Co.—Will either remove plant to Omaha or connect with East Chicago sewers.

E. I. du Pont de Nemours & Co.—Plans just completed for sanitary and trade waste plant to cost $500,000. Work will start immediately.

Fruit Growers Express Co.—Has completed connections with East Chicago sewers.

Inland Steel Co.—This plant of 12,000 has started work on a $1,000,000 system to take care of all sanitary sewage and industrial waste.

Socony Vacuum Oil Co.—Plans for sewage disposal to be signed this week. Has agreed to dispose of sanitary sewage through East Chicago system and to build oil separator system.

Texas Co.—Has completed connections with East Chicago sewer system.

Rogers Galvanizing Co.—Working on hookup with East Chicago sewer system.

Shell Oil Co.—Has completed hookup with East Chicago system.

Sinclair Refining Co.—Has completed sanitary sewage hookup with East Chicago system and is at work on $750,000 oil separator system.

U.S.S. Lead Refining Co.—At work connecting with East Chicago sewer system.

Youngstown Sheet and Tube Co.—Plans being completed to take care of own sewage and industrial waste.

Reservoir Cleaned by Bulldozer

By Glenn Duncan*

(From *Water Works News of New York State*)

The four million gallon capacity reservoir of Northville had been considerably reduced by silting and all attempts to clean the reservoir had been but partly successful. Heavy storms in 1945 washed a great amount of earth from around the upper dam spillway and added that earth to the already shrinking reservoir.

To clean the silt out of the reservoir, a ten-ton bulldozer was pressed into service and performed a miracle. In the operation, the mud pipe was opened, and as the water drained the bulldozer followed the receding water line. The bulldozer was used to push mud and slime on bottom of reservoir toward the mud pipe, where it was sluiced through with water from the upper reservoir.

In moving the silt forward, the method employed was to excavate a channel-way. As the water accumulated behind the mud plug in the channel lane, the operator would rupture the earth dam or plug, allowing the water to sluice the mud forward toward the drain. One short bank and the dam were cleaned by hand as they were too steep for good bulldozer operation. All banks were flushed under pressure from a mobile gas driven fire pump and hose unit of 500 gal. per min. capacity.

The reservoir is approx. 400 by 1500 ft. and at least three feet of debris were removed, making some 66,000 cu. yd. of silt actually cleaned out of the reservoir. Five men working four days, with the bulldozer working three days, did the job.

*Supt. of Water, Northville, N. Y.

AN EXPERIENCE WITH CHLORINE DIOXIDE TREATMENT

In Which a Small Water Utility Employs the HTH-Acid-Chlorite Method

By ALLAN G. DAVENPORT
Vice-Pres. and Manager
JAMESTOWN WATER CO.
JAMESTOWN, R. I.

JAMESTOWN, R. I., a summer resort town of approximately 2,000 year-round residents and an additional 1,200 during the summer months, has an average of 250,000 gallons of water supplied daily by the Jamestown Water Co. As there is not sufficient ground water, the sources of supply are two shallow reservoirs or ponds which impound spring and surface water from the surrounding swampy watershed which is not owned by the company.

The main source is the North Pond, (55 mil. gal.), where the water is soft and has a pH ranging from 6.0 to 6.5. Color ranges from 30 to 90 ppm. Turbidity is low.

The South Pond (15 mil. gal. emergency supply) color ranges up to 150 ppm. and the organic content is much higher. Both raw waters have strong swampy tastes and odors most of the time and occasional tastes and odors due to algae.

Treatment

Before chlorine dioxide treatment was initiated the treatment at the plant consisted of pre-ammoniation, chlorination, coagulation, sedimentation, filtration, and final pH correction. In cold weather, whenever the temperature of the water would drop below 45° F., the formation of floc became extremely difficult, if not impossible, during the relatively short retention time in the basins. Therefore, during the winter months the practice has been to discontinue coagulation entirely. The chlorine-ammonia treatment proved somewhat helpful in reducing chlorinous tastes and odors and enabled the maintenance of a sterilizing residual throughout the system, but the tastes and odors of organic origin in the raw water were not removed. Although the summer residents were particularly conscious of these tastes and odors, being unaccustomed to the water, many of the permanent residents also complained. Compliments to the Jamestown Water Co. on the quality of the water were nonexistent. Break-point chlorination was tried but was found ineffective.

The Author

Chlorine Dioxide Tried

Early in January, 1946, the writer was approached by Mathieson Alkali Works, Inc., and Proportioneers, Inc., in regard to making field tests on Mathieson's new Chlorine Dioxide Process, using Proportioneers' chemical feeders to feed the necessary chemicals to generate and apply the chlorine dioxide. Laboratory tests conducted by Proportioneers and Mathieson jointly had demonstrated the practicability of producing and applying chlorine dioxide (ClO_2) by proportioning hypochlorite solution and acid in continuous flow to a minor flow of water to produce a solution of hypochlorous acid and then reacting a solution of sodium chlorite with it, thus generating chlorine dioxide in solution. The Jamestown supply was chosen for the field tests as the water was a typical New England surface water, but with an unusually high organic content. Permission for the test was readily given and in mid-January ammoniation was discontinued, and

Water Purification Plant and Pumping Station—Jamestown (R. I.) Water Co.

Proportioneers diaphragm type Chem-O-Feeders were installed. Sufficient HTH (Mathieson High-Test Hypochlorite) solution to treat the main water flow to a dose of 0.5 ppm. of available chlorine was fed into a minor flow of water in header of plastic tubing. Sulfuric acid was then fed into the same header to convert the hypochlorite to hypochlorous acid and to produce a pH value of 3.0 or less. The hypochlorous acid solution was then conducted to the chlorine dioxide generator which was also constructed of transparent plastic. Sufficient sodium chlorite to treat the main water flow to 0.6 ppm. was then fed into the flow of hypochlorous acid entering the generator. Herein the reaction between the chemicals produced chlorine dioxide in solution as was shown by the characteristic deep yellow color. From the outlet of the generator the solution was conducted through plastic tubing to the plant influent. Analyses run on the chlorine dioxide solution showed complete conversion of the chlorite.

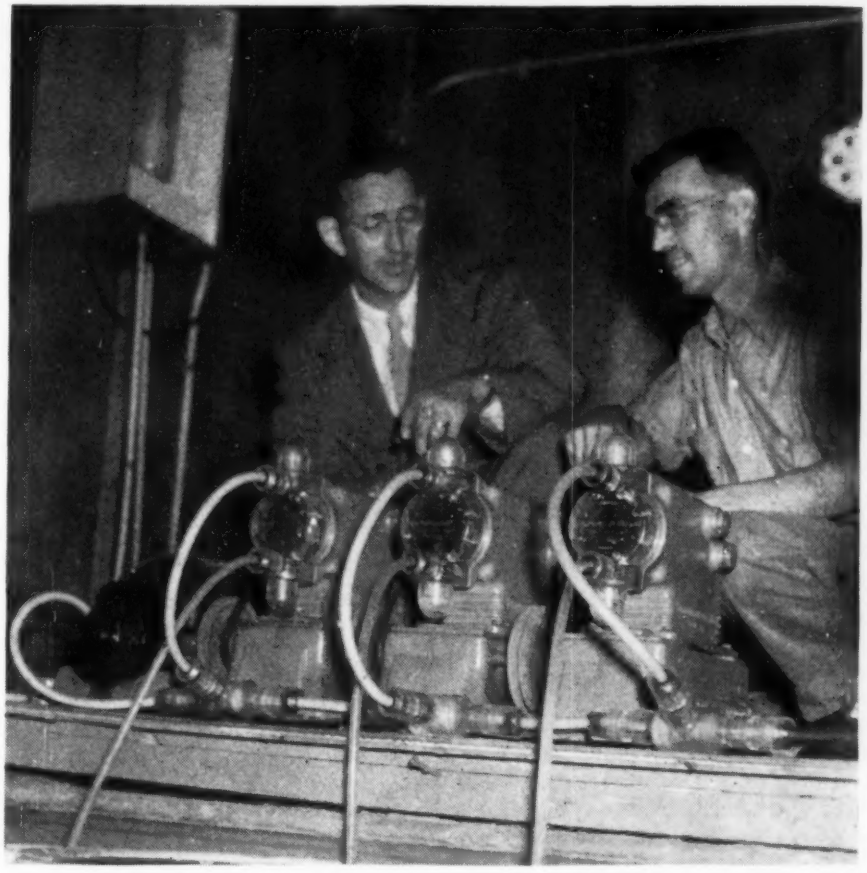
Point of Application and Results

The initial application of the chlorine dioxide, as has been noted, was made at approximately the same point as the introduction of the chlorine, but in the latter part of March when the practice of coagulation was resumed, the point of application of the chlorine dioxide was changed to the settled water well. The separate pre-chlorination dosage was set at approximately 2 ppm. and the residual in the settled water well after having been bolstered by the chlorine dioxide applied at this point just ahead of the filters was in excess of 1 ppm. The effluent from the single pressure filter to distribution and to the standpipe, riding on the transmission line, carried a residual of from 0.8 to 1 ppm. as measured with orthotolidine.

Results were observed almost immediately at the plant and a few days later taste and odor difficulties had disappeared from the whole system. Even when, for a two-day period, it became necessary to take water from the South Pond through a line which had not been in use for at least seven months, there were no complaints of "off" tastes noticeable even to those who knew of the change. Needless to say, the company was astounded when a number of people who had been chronic "kickers" for years remarked on the change in the water and complimented the quality.

At the present writing (September, 1946), the dosage of chlorine dioxide remains the same as was used initially. There have been one or two taste flareups of short duration which may be due to faulty operation or possibly to an unusually high organic load. Generally speaking, however, the water remains of high quality with regard to taste and odor.

From a bacterial standpoint the water is excellent. The first month after starting the new treatment there was one high bacteria count, although no coliform organisms were found. Since that time all samples taken from the system have been absolutely negative. A residual chlorine value of from .05 to 0.2 ppm. is found in all live parts of the distribution system.



The Temporary Installation of Chlorine Dioxide Equipment

Chem-O-Feeders exactly proportioning Hypochlorite - Acid - Sodium Chlorite solutions from crocks through the chlorine-dioxide generator in the upper left. A permanent "tailored" installation is to be made by Proportioneers. In the picture is Henry Armbrust of Proportioneers on left and Manuel Mello, our Plant Operator.

Conclusions

(1) Chlorine dioxide can be used to eliminate taste and odor difficulties in waters of a swampy nature.

(2) The treatment makes possible the carrying of a sterilizing residual through the system without taste.

(3) The hypochlorite, acid and chlorite method of generating chlorine dioxide is simple and efficient.

(4) It can be used by relatively untrained personnel.

(5) Dosage is not critical.

(6) The hypochlorite method of generating and applying chlorine dioxide can be used as advantageously in small water plants as in larger plants.

(7) The proportioning pumps and accessory equipment required are sufficiently low in first cost and maintenance to be attractive to even the small plant.

(8) The overall cost of the chlorine dioxide treatment is justified on the strength of the results observed and the very practical consideration that consumers were aware of an improvement in the product supplied.

Acknowledgment

The equipment was installed and tests were made under the supervision of Mr. John Synan of Mathieson Alkali Works and Mr. Henry Armbrust of Proportioneers, Inc.

HYDRAULICS FOR THE PRACTICAL WATER WORKS MAN

The Fourth of a Series of Articles

Friction and Resistance Loss; Pipe Line Losses; Roughness Effects

By ROBERT W. ANGUS, M.E.
Consulting Engineer
TORONTO, CANADA

IN EARLIER articles of this series reference has frequently been made to friction and resistance losses. This matter will now be examined in some detail, because friction losses in piping and other channels in which liquids flow is a most important matter. Dealing first with pipes, it is well known that the loss of pressure due to friction depends on the length of the pipe, the size of it, the velocity of the flowing water and on the condition of its internal surface. For pipes that are equally smooth inside, the friction head lost in pipes of the same size increases with the length of the pipe, as examples already given in previous articles indicate. Now, in addition, head loss also increases with the discharge increase through any definite pipe. In fact, many experiments show that for a particular pipe the loss of head due to friction varies almost directly as the square of the velocity of flow through the pipe. More generally stated, the friction loss varies directly with the velocity head.

The Author

Roughness of Pipes

The factor of greatest importance in connection with head loss due to friction is the condition of the internal surface of the pipe, more generally described as the *roughness* of the pipe. This is also the most elusive of all factors entering this problem, for no one has yet discovered an accurate means of classifying roughnesses, and the experimental measurement of the friction losses is very often the only way of comparing the roughness of pipes. It is true that the hand and eye can be of great assistance, for where pipes feel rough they are rough so far as the flow is concerned, and where lumps or projecting pieces of metal are observed the same is true.

On the other hand, a pipe may feel smooth to the hand and may yet offer much resistance to flow because it is not round, or because it has slight corrugations in it. A smooth pipe must not only feel smooth but it must be uniform in size, truly cylindrical, and free from bends. Good examples are drawn copper, lead and brass pipes, but iron pipes are often also very smooth, especially after they are coated or cement lined. Cement-asbestos and concrete pipes are often very superior in this respect, but even in the smoothest and best pipes the friction losses are not negligible, for the water flowing over the stationary pipe wall suffers considerable resistance.

In the game known as curling, the stone moves over ice, which is of course very smooth, yet there is enough friction to eventually stop the stone. If the ice has lumps on it, the stone stops sooner than otherwise, even though the lumps are smooth. Wavy ice produces much the same effect as ice with lumps and there is usually no way of predicting the effect of these factors except by making a few trials, and this is only done on ice which has been made as smooth as possible.

Friction Head and Power Lost in Friction

The friction loss or friction head is measured in feet or in pounds pressure per square inch and has been so indicated in the examples given. Since this leads to some confusion, an illustration or two may prove helpful. A car not having too much friction in its parts will, of itself, roll down a sloping road and will run at uniform speed if the slope is small, in which case the working of gravity along the slope supplies just enough power to overcome the friction of the car on the road. It gets its power in this case by "losing altitude," and if this loss of altitude is 10 ft. while the car moves down the slope a distance requiring 25 sec., then the power put into the car by gravity is its weight multiplied by the 10 ft. and divided by the 25 sec. required. This gives the power in foot pounds per second, and by dividing this power by 550, which is the number of foot pounds per second corresponding to one horsepower (33,000 foot pounds per minute), the horsepower lost in friction is found, assuming the car moved at uniform speed. If the above car weighed 4000 pounds, the power lost in friction was 2.91 H.P., but the "head" lost was 10 feet, regardless of the weight of the car or any other factor.

Such a loss in altitude (pressure) is, in hydraulics, referred to as the friction head and is clearly independent of the weight moving or the time taken; it is simply a number of feet.

In dealing with hydraulic problems, the friction head loss, in feet, is first calculated, and from this the horsepower lost in friction is found by multiplying this head loss by the *weight* (rather than volume) of water flowing per second and dividing this by 550. If, for example, the friction head loss is 6 ft. in a pipe carrying 4 cu. ft. per sec., the power lost in friction is $\frac{4 \times 62.4 \times 6}{550} =$ 2.72 H.P. (1 cu. ft. of water weighs 62.4 lbs.)

It is important at the outset to get the distinction between the head lost in friction and the power lost in friction. The former is a number of feet and is the quantity plotted on the diagrams accompanying previous articles.

Friction losses are so serious in hydraulic work that much experimental work has been and is being done in order to formulate laws for friction loss calculations. For pipes, the number of recorded experiments is nearly infinite and these form the main basis of our knowledge, although theory has also been helpful.

That the friction head *increases* at the same rate as the pipe length increases seems to be obvious, but it is not quite so clear why friction should *decrease* so markedly as the diameter of pipe increases, although a little consideration will show this to be the case.

Effect of Size on Friction Loss

Since the cause of all the friction loss is obviously the drag produced by the stationary pipe wall on the moving water, one may reason that the further the average particle of moving water is from the wall the less should be the friction. In a 6 in. pipe no particle of water can be more than 3 in. from the wall and the friction effect must be greater than in a 12 in. pipe where some of the particles are 6 in. away from the wall; in fact, it must be much less in the latter case as the average drop of water is twice as far away from

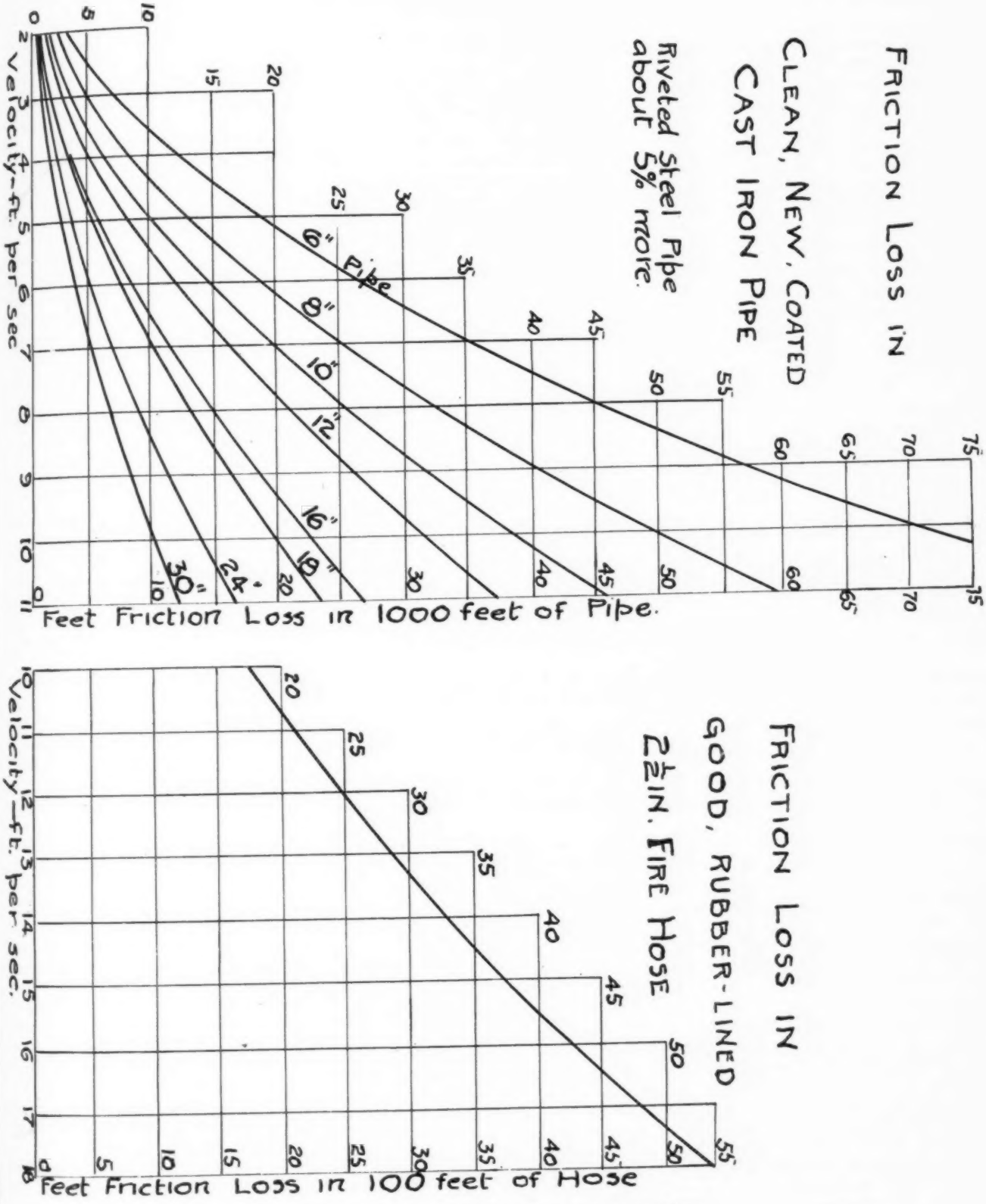


Fig. 18—Friction Losses in Pipes and Hose Lines

TABLE II

Friction Factors for Smooth, Clean, Coated Cast Iron Pipes

(Add 5% for riveted steel and at least 50% for old rusted pipes. Copper and brass and lead pipes have lower values.)

Pipe Diameter in.	Velocity in Pipe, Ft. per. Sec.					
	1.0	2.0	3.0	4.0	5.0	10.0
1	.035	.032	.030	.029	.027	.024
2	.033	.030	.028	.027	.026	.024
4	.031	.028	.026	.025	.025	.023
6	.029	.026	.025	.024	.024	.022
12	.025	.023	.022	.022	.021	.020
16	.023	.022	.021	.021	.020	.019

the wall as it is in the small pipe. Whether or not one would expect the effect to be as great as it is, experiments show that in such a case as that given, the friction head loss in the large pipe would be just almost exactly half what it would be in the smaller pipe, provided both were equally smooth and both carried water at the same velocity.

Care must be used in this matter, however, for the larger pipe delivers four times the water that the small one does, because its area is four times as large while the velocity is the same in both. Therefore, while the *loss of head* is only half as great in the large pipe, the actual horsepower lost in the large pipe is twice that in the small one. Therefore, it is the loss of head that decreases at the same rate as the diameter increases.

Formula for Friction Head

Experiments also show that the loss of head in a particular pipe varies almost exactly in proportion to the velocity head, as has already been stated, and when the effects of length, velocity and diameter are combined, the loss of head is expressed by the formula

$$F = f \frac{l}{d} \times \frac{V^2}{64.3}$$

where the length (l) and diameter (d) are in feet and (f) is the *friction factor*, and depends almost exclusively on the roughness of the inside of the pipe. Curiously enough, experiments show that there is actually a small variation in (f) as the diameter and the velocity vary, but the latter have not a very great effect in pipes of uniform roughness and it only means that the formula does not take exact account of the effect of diameter and velocity. But it is practically very much easier to calculate the friction loss by this simple law, with an accompanying table of suitable friction factors, than it would be by the use of a much more complicated formula which would take exact account of size and velocity in such a way as to make (f) depend only on the roughness.

Friction Factors

The friction factor table in common use is a very old one and was made for straight, circular pipes of about the same internal roughness as is found in tar coated cast iron water pipes commonly used for water works service. The factors are too high for such smooth pipes as brass and copper and are too low for rust encrusted cast iron pipes, but a few values as given in Table II will be found useful in most cases occurring in practice, and will also serve to show how the factor is affected by size and the velocity of flow.

TABLE III

Loss of Head in Fittings and Special Castings

(Expressed as the equivalent feet of straight pipe having the same loss.)

Screwed tee, or square elbow	70 ft.
Screwed short radius elbow	30 ft.
Screwed long radius elbow	20 ft.
Cast bell and spigot or flanged, long radius 90 deg. bend	10 ft.
Entrance loss where pipe projects into reservoir	30 ft.
Entrance loss where end of pipe is flush with inner wall	20 ft.
Entrance loss, entrance well rounded (bell mouth)	0 ft.
[Discharge end loss, where pipe is kept full diameter, discharge end submerged, is equal the velocity head in the pipe, or approximately 40 ft. of pipe].	

As an illustration, a nearly new 6 in. cast iron pipe is delivering 500 U. S. gallons of water per min.; what would be the friction loss in a length of 2000 ft.? From Table I (see earlier installments) the velocity is found to be 5.66 ft. per sec. From Fig. 12 (see earlier installment) the velocity head is 0.50 ft., while Table II gives the friction factor as 0.0235 approximately, so that the loss of head is

$$F = .0235 \times \frac{2000}{6/12} \times .50 = 47 \text{ ft.}$$

If it was desired to increase the discharge 50 per cent, i.e., to deliver 750 gallons per min., then the velocity would be 8.49 ft. per sec., the corresponding velocity head 1.12 ft., and the friction factor would be 0.0226 (Table II), and if these quantities are put in the formula the friction loss is found to be 101.2 ft., or 2.15 times what it is for the smaller flow.

While on this matter it might be well to call attention to the effect of the size of the pipe on the friction loss. To somewhat exaggerate the case, let us suppose that a 12 in. pipe is used instead of the 6 in. pipe, and that it delivers the larger quantity of 750 gallons per min., which will mean the low velocity of 2.12 ft. per sec. This corresponds to a velocity head of 0.07 ft. and a friction factor of 0.0229 and the calculated loss of head (F) is easily found to be 3.21 ft. as compared with 101.2 ft. for the smaller pipe. It is scarcely justifiable to use such a large pipe for this job, as the velocity is very low, but if anticipated increase of demand in future as well as deterioration through age are considered, the larger pipe may be desirable. The calculation shows very clearly the effect of increasing the size of the pipe.

For convenience in solving this and similar problems, Fig. 18 has been prepared. It gives the loss of head in 1000 ft. of clean, new cast iron pipes of various sizes of from 2 in. to 30 in. and for the usual range of velocities. Separated from the other curves is one showing the loss in 100 ft. of 2½ in. fire hose for a good range of velocities, and it is to be observed that velocities in fire hose are much higher than in regular iron pipes used in water works service. As already pointed out, these losses are 5 per cent higher in riveted steel pipes and 50 per cent higher in many old and rusted pipes, so that some judgment must be used where the roughness is different from that used in plotting the curves. Of course, brass, lead and copper pipes have smaller losses than the diagram shows.

Loss in Fittings, Specials and Valves

The discussion so far has been confined to round, straight pipes, but actual lines usually have elbows, bends, valves and other sources of loss which must be included. The loss of head in each of these cases is also proportional to the velocity head in the pipe and probably the most accurate way to deal with such losses is to multiply the velocity head by a *coefficient of resistance* found by experiment for each type of fitting or valve and many tables of these coefficients have been made. Some of these values are given in Table III. For the degree of accuracy demanded in ordinary work, however, the loss of head in a fitting or special is often expressed as the number of feet of straight pipe having the same loss and this length is added to the length of straight pipe involved.

For example, the loss of head in a 90 deg. short radius 6 in. screwed elbow is 0.75 of the velocity head in the pipe. But Table II gives the a

erage friction factor for 6 in. pipe as about 0.025, which means that a rough average value of the loss in 6 in. straight, smooth pipe is $0.025 \times l/d$ times the velocity head. If l/d is 30, this is equivalent to a straight piece of 6 in. pipe $30 \times 6 = 180$ in. long (i.e., 15 ft.) the loss of head in this piece would be 0.75 times the velocity head and it would be correct to say that if a 6 in. pipe had screwed 90 deg. elbows of short radius in it the loss of head in the line could be calculated as for straight pipe if for each such elbow the 15 ft. equivalent of straight pipe are added. Thus, 100 ft. of pipe with two of these elbows in it would have the same loss as 130 ft. of straight pipe, and so on.

The values given in Table III are typical, but it must be remembered that there are many types of elbows, bends, etc., and judgment is necessary in using the table. For example, in the case of the 6 in. elbow just mentioned the losses in the elbow will be much increased if burrs are left on the inside of the pipe ends and the tabular values are only to be used in well connected fittings. Since in most pipe lines the losses in fittings are usually relatively small compared with those in the straight part of the line, no serious trouble will arise if the values used for the fittings are somewhat inaccurate, but in many cases the loss in the fittings may easily exceed those in the straight part of the pipe and then care must be used in selecting proper values.

In the case of valves the losses are much more difficult to evaluate, because valves differ a great deal in their construction, and it is usually difficult to tell just how far the valve is open. In this case it is best to express the loss as a coefficient to be multiplied into the velocity head and Table IV gives a few such coefficients.

TABLE IV
Losses of Head in Gate Valves
(Expressed as coefficients to be multiplied into the velocity head in the pipe.)

Gate Valve Size, in.	Ratio of number of turns valve is open to number required for full opening			
	Full Open	¾ Open	½ Open	¼ Open
2	.16	.68	3.0	20
6	.12	.49	2.5	15
10	.07	.41	2.3	13

For Globe Valves, full open, the losses are much higher than for gate valves and the coefficient varies from around 14 on half inch sizes to around 6 on two inch valves, and will somewhat decrease with the larger sizes.

Just in passing, however, attention might be called to some striking results in Table IV, the first being the rapid way the losses rise as the valve approaches the closed position. As the valve closes it reduces the flow partly because the area through it becomes smaller but also because of the rapid increase in resistance in it; the combination of these two produces the final result. Certain modern valves have much lower friction losses than gate valves have, in which case their effect is largely due to the reduction of area in them. Another thing Table IV shows is that the loss is much lower for large valves than for small ones, but that the losses are not negligible even in the fully open valve.

Most of this article has had to be taken up with explanation of how to calculate friction losses, together with necessary data. The next installment will apply the method here explained to some common practical problems.

(Additional installments to follow.)

Buffalo N. Y. Commended for Work on Stream Pollution Abatement

State Legislative Committee Hears and Commends Progress Report

At a regional conference on water pollution problems in western New York state on Oct. 16, the Pollution Abatement Sub-Committee of the N. Y. State Legislature, Joint Legislative Committee on Interstate Cooperation, chairmaned by Harold J. Ostertag, heard an informal progress report on the success the Buffalo Sewer Authority is having in attacking the stream pollution abatement problem in the boundary waters of the city.

Persons from seven counties attended the conference at which representatives of the N. Y. State Health, Conservation and Commerce Departments spoke, outlining the attitudes of these several governmental agencies toward stream pollution. The purpose of these regional meetings, of which there will be seven, is to ascertain information that will aid the Ostertag Committee in setting up a legislative program for the State to attack the statewide problem.

Pointing to the cooperative efforts and results secured by the Buffalo Sewer Authority as an example of the proper approach, Henry W. Keitzel, Chairman of the Authority, called for the establishment of a stream control commission in the State of New York.

An informal technical progress report on the work being done in the Buffalo area was presented by Dr. George E. Symons, Consultant to the Buffalo Sewer Authority. Dr. Symons, former Chief Chemist for the Authority, was awarded the Kenneth Allen Memorial Award for Research by the N. Y. State Sewage Works Assn. in 1940 for his paper on "Studies on the Buffalo River in 1936-39."

A. B. Campbell Heads Nat. Assn. Corrosion Engrs.

A. B. Campbell, formerly eastern representative of Hughes Bros., has accepted the position of Executive Secretary of the National Assoc. of Corrosion Engineers, with headquarters in Houston, Tex.

Started in 1943, the N. A. C. E. operates as a clearing house for the exchange of information on corrosion. A pamphlet lists the purposes of the organization, which is devoted to corrosion problems in transportation, oil and gas, electric power, water supply and sewage treatment, among other industries.

The magazine of the association is titled "Corrosion" and is published at 711 Main St., Houston, Tex.

Col. Arthur R. Harris New President of Inst. of Inter-American Affairs

Succeeds Col. Gotaas, Now Prof. of Mun. and San. Engr., Univ. of Calif.

Col. Arthur R. Harris became President of the Institute of Inter-American Affairs and the Inter-American Educational Foundation last Aug. 6. He succeeded Harold B. Gotaas, Col., San. Corps, Aus., who resigned to accept the position of Prof. of Sanitary Engineering at the University of California.

Col. Harris is well known to Latin American republics, having spent several years of his military career as Military Attache to Guatemala, Honduras, Nicaragua, El Salvador, Costa Rica, and Panama, and during a part of the war as Chief, Latin American, Military Attache and Foreign Liaisons Section, War Department.

OHIO SECTION ESTABLISHES WENDELL R. LA DUE CITATION*

AT the annual meeting of the Ohio Section A. W. W. A., held in Columbus on Oct. 10-11, the **Wendell R. LaDue Citation** was created to honor both Mr. LaDue, Pres. of A. W. W. A., and members of the Ohio Section who have shown their sustained interest in water works affairs by continuous active membership in the A. W. W. A. for twenty years.

Those honored at this meeting included the following:

35 years—A. G. Levy, Cleveland; Philip Burgess, Columbus.

30 years—Charles P. Hoover, Columbus; F. H. Waring, Columbus.

25 years—J. W. Ellms, Cleveland; Isador W. Mendelsohn, Columbus; L. A. Marshall, Cleveland; J. S. Gettrust, Kent; George N. Schoonmaker, Toledo.

20 years—Philip J. O'Conner, Warren; Wm. I. Van Armun, Youngstown; A. S. Hibbs, Chillicothe; H. P. Jones, Toledo; W. W. Morehouse, Dayton; Clarence B. Hoover, Columbus; Frank W. Jones, Cleveland; Frank Tolles, Cleveland; Carl C. Walker, Jr., Columbus; J. B. Romer, Barberton; D. A. Russell, Youngstown; T. R. Lathrop, Columbus; Floyd G. Browne, Marion; C. W. Foulk, Columbus; W. L. Havens, Cleveland; Fred W. Hanks, Cleveland; John C. Prior, Columbus.

New Officers

The meeting had an official registration of 241, but in addition there were some 60 students who attended the sessions. Officers elected for the coming year were:

President: Paul D. Cook, Supt., Painesville, Ohio.

Vice President: Hayes R. Kuhns, Leadite Co., Killbuck, Ohio.

Secretary-Treasurer: F. P. Fischer, Wallace & Tiernan Co., Cleveland, Ohio.

New Trustee: A. A. Ulrich, Vice Pres., Ohio Water Service Co., Massillon, Ohio.

Hold-over officers include H. P. Jones as A. W. W. A. Director, Ira Hoover (Montpelier) and T. R. Lathrop (Columbus) as Trustees, and L. J. Hoffman, Akron, as Consulting Secretary.

Technical Papers

In addition to a Round Table Discussion led by T. R. Lathrop, Ohio Dept. of Health, there was panel discussion and a question box; there were 14 papers distributed over five sessions.

C. V. Youngquist, Chief Engr., Ohio Water Resources Board, Columbus, said he hoped that the "Functions of Ohio Water Resources Board" would continue to be fact finding and research and would not become regulatory.

A. A. Ulrich, Vice Pres., Ohio Water Service Co., Massillon, presented his views on "Public Relations —A Betterment Program," and stressed the benefits to be obtained by placing responsibility on the meter reader to maintain good will in making his on-the-spot checkup if readings indicate any unusual water consumption.

According to a paper by W. W. Morehouse, Director, Dayton Water Dept., there is no general method for "Financing City Water Main Extensions Beyond Corporate Limits."

With the cost of living increasing steadily, the question naturally arises, "Must Water Rates Increase with Living Costs?" and the various aspects of this question were presented in a scholarly manner by Frank C. Tolles, Cons. Engr., Havens and Emerson, Cleveland.

The Hazen and Williams Formula and its application to determining the benefits of lining cast iron pipe with cement to maintain "The Carrying Capacity of Cast Iron Pipe" was explained by Thomas F. Wolfe, Research Engineer, Cast Iron Pipe Assn., Chicago, Ill.

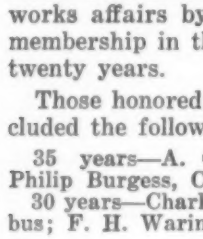
"Standardization of Hydrants, Valves, and Meters in the Distribution System" may or may not be desirable, depending on standards in neighboring communities, longevity of manufacturer, and other factors, according to G. J. Van Dorp, Commissioner, Toledo Water Department.

Representing a complete and understandable explanation of two methods of building and financing public utilities, the paper on "Revenue Bonds vs. General Obligation Bonds for Water Works Financing" was considered an outstanding presentation by the audience. It was presented by Wm. S. Evatt, Attorney at Law, Columbus.

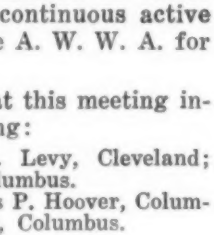
Another outstanding paper, inspiring in its message, human in its treatment, and interesting in its presentation, was the talk on "The Personnel Equation in Water Works" by Wendell R. LaDue, Pres., A. W. W. A., and Gen. Mgr. of the Water and Sewage Depts. of Akron, Ohio.

Other papers dealt with the Lima Water Works, Office Procedure, Pipe Sizes, Meter Maintenance, and the relation of a fire department to a water department.

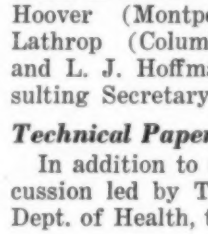
The Wendell R. La Due Citation
For Continuous Active Membership in A.W.W.A.



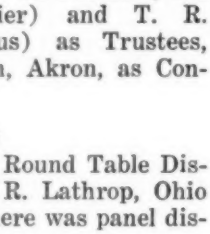
Honored
W. R. La Due
Chief Engr.
Water Dept.
Akron



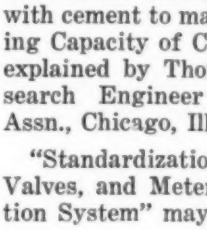
35 Years
Philip Burgess
Cons. Engr.
Columbus



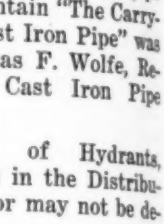
30 Years
C. P. Hoover
Chemist
Water Dept.
Columbus



30 Years
F. H. Waring
Chief Engr.
State Health Dept.
Columbus



25 Years
J. W. Ellms
Commissioner
of Sewerage
Cleveland



25 Years
J. Gettrust
Supt. Filt.
Water Dept.
Akron

(In addition, one 35-yr. man, two 25-yr. men, and seventeen 20-yr. men)

*A report prepared from notes submitted by F. P. Fischer, Secy., Ohio Section, A. W. W. A.

VALUE OF MAINTENANCE IN FILTRATION PLANTS

A. E. CLARK*
Dept. of Public Works
NASHVILLE, TENN.

THERE are three principal considerations in filter plant operation. In the order of their importance these are: (1) safe water, (2) maintenance, (3) cleanliness. These three basic considerations should be instilled in the minds of all operating personnel from the supervisor on down.

Maintenance pays dividends, not only in dollars and cents, but in the security obtained in the knowledge that all equipment is or can be operated when required. The quality of the water produced depends on properly maintaining the equipment used in its production. A breakdown in one part of the plant can have a bearing on the operation of all other parts and possibly endanger the safety of the water produced during the breakdown.

In order to properly maintain the equipment in a filtration plant it is necessary that the proper tools be provided and these should be kept on a tool board or in such a manner that each tool has its place, and when not in use is in its place. The tools should be cleaned after each use and if one is broken or lost it should be replaced immediately. Proper tools are necessary, but it is important that there be someone who knows how to use them. Too many times the wrong tool is used, or it may be that the right tool is used improperly. Stillsen wrenches are not made to loosen or tighten square or hex nuts, and on the other hand, the same nuts can be ruined by using the wrong size open end wrench or a crescent wrench improperly adjusted. Pliers have their place, but not to loosen or tighten square or hex nuts. The point to be emphasized is to have employees who have been taught to use the right tool and use it properly.

Money can be well spent in a large plant by employing a millwright who knows his business. He may not be familiar with the special type of equipment used in a filtration plant, but he soon learns. In the smaller plants every effort should be made to employ those competent to repair or adjust equipment; however, there is usually a limit to the amount of repair work which should be left to the small plant operator. When outside help is brought in, the operator should be able to explain the opertaing principle of the particular piece of equipment and know what the trouble is.

The Author

Oil, grease, packing and paint are probably the cheapest and most important maintenance materials purchased. It is assumed when purchasing a piece of equipment that the manufacturer has developed, tested and produced it for that particular purpose. Grease cups, grease fittings and oil receptacles have been provided to keep the equipment operating properly, if used as instructed. The furnisher of equipment usually supplies printed instructions covering the operating principles and care as well as instructions for the correction of operating difficulties which may arise. The instructions should be carefully read and understood and not filed away and forgotten.

Value of a Lubrication Schedule

The writer has found that in order to be sure all equipment was properly greased or oiled, a schedule was most helpful. The furnisher's instructions usually specify the type and number of oil or grease recommended, and since the major oil companies can furnish all types and numbers, the one from which purchases are made can supply those required.

A mimeographed schedule showing the name of the equipment, type of grease and/or oil, frequency of greasing and/or oiling and date carried out is a simple way of checking. This is best done by one man, since if left to more than one, except where each one has a certain part of the plant or equipment, there are quite likely to be times when some of the equipment is not greased or oiled. The man doing the greasing and oiling should understand how, also the importance, of properly lubricating equipment. The proper type of packing is essential as well as the correct sizes. In nearly all cases the manufacturer specifies the type and size of packing to be used, and where this is the case the instructions should be followed. Packing of a pump or other equipment should be done right and the supervisor should check and see that it is, otherwise serious difficulties may arise. Packing nuts should be kept sufficiently tight to prevent leakage and an extra ring of packing added at the proper time or if necessary they should be repacked.

All of the operating personnel should be sufficiently familiar with the equipment and apparatus throughout the plant so that if any part is not functioning properly, they will know it and report the trouble immediately. If duplicate equipment is provided, and this is usually the case, the spare should be put in service and the other checked and whatever trouble is found repaired or adjusted as soon as possible.

When mentioning equipment, one usually thinks of mechanical apparatus, but in a filtration plant the filter sand, gravel and underdrain system are as much a part of the equipment as a pump or meter. Therefore, proper maintenance of the filters is just as important as any of the mechanical equipment. Regular checks of the sand should be made, as well as checks for hard spots above the underdrains. If small mud balls start to accumulate the condition should be remedied or other means provided to keep them at a minimum. If hard spots develop above the underdrains, denoting a portion stopped, this condition should be corrected as soon as noted.

The examples cited apply to all apparatus and equipment. Gauges, particularly, should be kept in good condition in order that readings when taken are known to be correct. If they did not serve a useful purpose they would not be installed. Meters are the same. A meter which does not give correct readings is valueless and dangerous, since the information

*Formerly Water Supply Engr., Volunteer Ordnance Works, Chattanooga, Tenn.

given cannot be used effectively if dosages are applied in accordance with the meter readings and also where dosages are varied automatically with the meter.

Chemical Feeders

The dry feed chemical machines should be checked regularly. If alum is used and the solution tank is lead lined, repair a leak through the lining right away. The operating mechanism may start to show corrosion. If and when it does, clean and paint it before corrosion proceeds too far, and causes the machine to become inaccurate or cease functioning as a feeder.

Chlorinating apparatus should be well understood. The manufacturer furnishes a book of instructions and if it is followed there should be relatively little trouble. A chlorine leak must be repaired immediately, because it will not stop but grow worse. Here again the man doing maintenance work must know the apparatus to successfully keep it in proper operating condition. Using new gaskets and the proper ones each time a joint is broken is the best practice and knowing how to tighten the joint is important. Wrenches are furnished by the manufacturer for this purpose and a 10 or 12-inch crescent wrench used in their place is only inviting trouble. The writer has seen this happen. Use packing, gaskets and spare parts furnished by the manufacturer. As an example, a small silver pin is used in one model of a chlorinator and in the ammoniating apparatus the pin is made of steel. It was necessary to replace one of the silver pins in one of the chlorinators and a new maintenance man, not thinking it made any difference, replaced it with one of steel, which lasted a relatively short time, and until it was explained why it was necessary to use silver in place of steel, he could not understand why the steel pins would not last and the chlorinator not operate properly. He had been given the instruction books and ordered to study them, but evidently did not do so.

Valves, Meters, Pumps

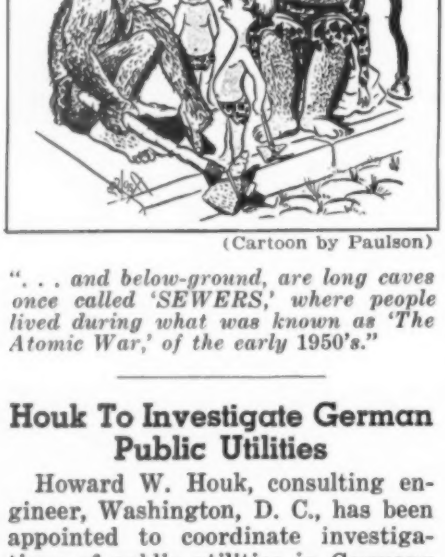
Hydraulic valves, either oil or water operated, should be checked frequently for leaks, and the packing nuts tightened to prevent leakage or if this cannot be done, repacked.

All meters should be checked at regular intervals for accuracy and if found inaccurate, corrected immediately. Depending on the type of meter and the maintenance personnel, it is sometimes necessary to call in someone specially trained in instrument work or a factory representative. If a factory representative either installs the equipment or is called in to correct trouble, every advantage should be taken of his knowledge of the apparatus so that in the future the trouble can be corrected by the maintenance man.

If pumping is also done at the filtration plant, all operating pumps should be checked regularly, noting the suction, discharge and header gauge readings and indicated rate of pumping as shown by the meter. Bearings are checked at the same time the gauges are read. Any variation from normal pressures or meter readings should be investigated immediately. Properly lubricated bearings and proper packing do not usually give trouble, but since there can be trouble, check up on any condition which might indicate improper operation.

The point the writer has tried to stress is to find the troubles while they are small and easily corrected, rather than to continue operation of a piece of equipment which obviously, sooner or later, is bound to break down if corrective measures are not taken.

Maybe This Ain't a Joke, Son!



(Cartoon by Paulson)

". . . and below-ground, are long caves once called 'SEWERS,' where people lived during what was known as 'The Atomic War,' of the early 1950's."

Houk To Investigate German Public Utilities

Howard W. Houk, consulting engineer, Washington, D. C., has been appointed to coordinate investigations of public utilities in Germany for the Technical Industrial Intelligence Division, the Office of Technical Services, Department of Commerce. Mr. Houk will study recent developments in bridge and highway construction, river and harbor improvement, soils and soil mechanics, and sewage disposal.

Northwestern Univ. Holds Water Works Institute

A Water Works Institute is being conducted at Northwestern University, Evanston, Ill., this Fall, sponsored by the University and the Ill. Sect., A. W. W. A., for water works personnel in Northern Illinois. Beginning Oct. 9, seven weekly lectures have been scheduled. The program for the Institute has been arranged by Prof. Merrill B. Gamet, Northwestern Univ., Chairman; Horace R. Frye, Supt. of Water at Evanston and Trustee of the Illinois Section; Prof. Lewis H. Kessler, Northwestern University, and H. H. Gerstein, Supt. of Filtration, City of Chicago.

Among the topics covered at the various lecture sessions have been Water Supply and Public Health, Public Relations, Chlorination, Sterilization of Mains, Taste and Odor Control, Laboratory Tests and Control, Maintenance, Filter Plant Operation, Water Softening, Scale Inhibition, Meter Repair, and Preventive Maintenance.

Emergency Powers of Utilities Needed to Obtain Chlorine During New York Trucking Strike

Nassau County on Long Island, N. Y., was faced with a crisis during the recent trucking strike in New York City because chlorine supplies at water and sewage plants became dangerously low. To meet the situation, Nassau County empowered John C. Guibert, Commissioner of Public Works, to use the war power retained by the legislature after the state war council was abolished.

Mr. Guibert assigned a Nassau public works department truck to pick up a shipment of 38 tanks of chlorine from the Mathieson Warehouse. The truck, manned by volunteers, was accompanied by a detective and was escorted through the strike-bound streets of New York by fire trucks. The cylinders were distributed to four sewage plants and one water plant.

FEDERATION S.W.A. ATTENDANCE AT TORONTO MEETING SETS RECORD

Registration of 812 Tops Previous High by 200

Federation Presidents

J. K. Hoskins
U.S.P.H.S.
Washington
(Retiring)

F. S. Friel
Cons. Engr.
Philadelphia, Pa.
(Incoming)

WHEN one begins to write about the 19th Annual Meeting of the Federation of Sewage Works Assns. at Toronto on Oct. 7-9, it is difficult to find sufficient superlatives to adequately express the proper appreciation and appraisal of this, the largest meeting of the Federation yet held.

While the official registration of 812 topped the previous high by an even 200, it is known that there were at least another two dozen or so persons who attended some phase of the convention but did not register. In addition to setting a new high registration at which future meetings must shoot, this meeting set many other unusual precedents of interest.

For one thing, the gracious hospitality of the Canadians and the Canadian Institute on Sewage and Sanitation as hosts is something to remember with delight. The experiment of beginning the convention on Monday (board meeting on Sunday) and ending on Wednesday seemed to meet with general approval. A chance to participate in the guided discussion type of operators' forum as it is carried on in Canada repaid many persons for the trip.

Among the many other features of interest and enjoyment were the entertainment provided, particularly the choral group on Sunday evening, the Club Room before and after each meal; the Canadian Institute luncheon; food, the like of which was unobtainable in the States at the time; some really interesting technical papers; and pervading the spirit of the whole meeting, the quietly efficient organization and operation of the mechanics of the convention, a tribute to the ubiquitous spark plug, Dr. A. E. Berry, Secy. of the Canadian Association.

Canadian Inst. Presidents

H. S. Nicklin
City Engr.
Guelph, Ont.
(Retiring)

N. MacNicol
Comm. of Works
Forest Hill, Ont.
(Incoming)

Key Man

A. E. Berry
Chief Engr.
Ont. Dept. Health
Toronto
(Convention Mgr.)

New Brass

Geo. S. Russell
Cons. Engr.
Russell & Axton
St. Louis, Mo.
(New Vice-Pres.)

Although the number of exhibitors was relatively small (35), the exhibits themselves were interesting and informative, several new pieces of equipment being unveiled for the first time. The inauguration of a press room where copies of the technical papers were available before being read, was hailed by members of the technical press. Prizes and gifts for the ladies who helped make the meeting a success ranged from orchids to English China tea-cups and large silver trays.

Few there were who did not take advantage of the opportunity to purchase some Canadian merchandise, woolens, china, etc., but to the disappointment of many, stocks of these materials were not great. For the ladies, a trip through the Parliament Buildings, a bridge party, and luncheon at the Old Mill were something to be remembered.

A reporter of this meeting would be distinctly remiss in his duty if, in his enthusiastic praise, he failed to mention the work of Secretary W. H. Wisely and the officers of the Federation who presided and otherwise aided in the mechanics of the meeting. And having thus expressed an opinion shared by many, this reporter can now proceed with the more prosaic story of the meeting.

Business Meeting

In opening the business session, **Adm. J. K. Hoskins,** Pres. of the Federation, remarked on the healthy growth of the Federation during the past year, wherein two new associations were added and the general membership increased by 13 per cent to a total of 3658. Pres. Hoskins also reported that four other associations are in the process of affiliating with the Federation.

Pres. Hoskins announced that the next meeting of the Federation would

Exhibits and Diners

At the Lieut. Governor's Tea

Mrs. W. H. Wisely (Champaign, Ill.) and Mrs. A. E. Berry (Toronto) serving — *Mrs. Linn Enslow (New York), Mrs. A. V. DeLaporte (Toronto), Mrs. O. V. Ball (Toronto)* — *Mrs. George Gass (Toronto), serving; Mrs. A. H. Niles (Toledo), Mrs. L. B. Barnes (Bowling Green, O.)*

be held next July in San Francisco, concurrently with the Amer. Water Works Assn.

At the meeting of the Board of Control, the following officers were elected:

President
Francis S. Friel,
Albright and Friel, Cons. Engrs.,
Philadelphia, Penna.

Vice President
George S. Russell,
Russell and Axon, Cons. Engrs.,
St. Louis, Mo.

Treasurer
W. W. DeBerard, City Engr.,
City of Chicago,
Chicago, Ill.

Director at Large
Anselmo F. Dappert,
Prin. San. Engr.,
N. Y. State Dept. of Health,
Albany, N. Y.

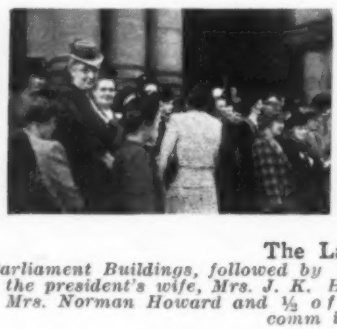
Secretary-Editor
W. H. Wisely,
Champaign, Ill.

The Secretary's report, presented by W. H. Wisely, confirmed the remarks by Pres. Hoskins on membership growth, and commented on the publication of the Journal and manuals of practice. The Journal with an increased circulation of more than 50 per cent in the last few years hardly has enough paper under the current shortages. Advertising pages were up 40 in 1945 over 1944 and this gain has held up during 1946. It has now been decided to begin publication of the Journal on a monthly basis with the January 1948 issue.

The Manual of Safety has been distributed to more than 6500 persons, and the Manual on Fertilizer, which will contain 120 pages, will soon be printed and 3000 copies will be ready for distribution.

In carrying out the duties of the secretary, Mr. Wisely has traveled 40,000 miles in the past two years and has visited at least one meeting of every association now in the Federation. Mr. Wisely's office has also answered 109 personal inquiries of members, of which 80 inquiries were for technical service and 29 concerned personnel.

More than 800 new members were obtained during the past year, and the Journal had a 90 per cent renewal of subscriptions. The financial statement of the Federation indicates that the net worth will increase to more than the $32,000 of last year.



The Ladies

Gathering for their visit to the Parliament Buildings, followed by a tea and reception by Canada's Lieut. Governor Matthews and Mrs. Matthews. Nearest center is the president's wife, Mrs. J. K. Hoskins (tall hat), Mrs. Geo. Morgan, Mrs. Wm. Storrie, Mrs. Jim Kinney (chmn. ladies' ent. com.), Mrs. Norman Howard and ½ of Mrs. A. E. Berry—all of Toronto, and members of the ladies' comm ittee.

Honors and Awards

Because of the fact that there was no convention of the Federation in 1945 (only an annual Board of Control Meeting), formal presentation of 1945 honors and awards was made at the Toronto meeting. Dr. A. E. Berry, Pres. of the Federation in 1945, made the presentations as follows (these were reported in *Water Works & Sewerage* last year but are briefly restated here):

Harrison Prescott Eddy Award
(For a published contribution on sewage research)
H. Heukelekian, Assoc. Prof.,
Rutgers University,
New Brunswick, N. J.

The contribution was entitled "The Relationship Between Accumulation, Biochemical, and Biological Characteristics of Film, and Purification of Biofilters and Standard Filters," published in *Sew. Wks. Jour.*, Jan., Mar., May, and July, 1945.

George Bradley Gascoigne Award
(For a published contribution on sewage works operation)
LeRoy Winfield Van Kleeck,

Harrison Prescott Eddy Award (for Research) to Dr. Lloyd R. Setter, Principal Chemist, New York Dept. of Public Works.

George Bradley Gascoigne Award (for Operation) to John D. McDonald, Supt. of Sewage Treatment, Springfield, Mass.

Charles Alvin Emerson (for Service to Federation) to Harold Warner Streeter, Sanitary Engr., Director of Water and Sewage Investigations of U. S. Pub. Health Service, Cincinnati, Ohio.

Honorary Membership to Dr. Willem Rudolfs, Chief, Water and Sewage Dept. of N. J. Agr. Expt. Station, New Brunswick, N. J.

Kenneth Allen Awards (for service to Member Assns.) to Joe Williamson, Jr. (Fla.), Murray Alderson Wilson (Kansas), George S. Russell (Missouri), Frederick Holman Waring (Ohio).

The **1946 Honors and Awards** were presented to the following persons:

Tea Bound

???—Once upon a time we had these ladies' names—but, that was "once upon a time." — *Mrs. Van Porter Enloe (Atlanta), Mrs. W. H. Wisely (Champaign, Ill.), Mrs. Jacques Benoit (Montreal)* — *Mrs. J. W. Johnson (Buffalo), Mrs. H. E. Schlenz (Chicago), Mrs. C. C. Larson (Springfield, Ill.)*

Treasurer
W. W. DeBerard
City Engr.
Chicago
(Re-elected)

Exec. Sec'y
W. H. Wisely
Champaign, Ill.
(Heard Praises)

Prin. San. Engr.,
Conn. State Dept. of Health,
Hartford, Conn.

The contribution was titled "Operation of Sludge Drying and Gas Utilization Units" and published in the Nov. 1945 issue of *Sew. Wks. Jour.*

Sub-committee, and as a member of the Committee on Standard Methods."

William D. Hatfield Award

(For the outstanding 1945 sewage works operation report)

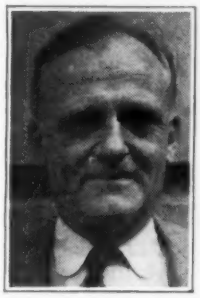
Walter M. Kunsch,
Engr.-Manager,
Urbana-Champaign San. District,
Urbana, Ill.

Mr. Kunsch's report for the operation of the Urbana-Champaign Sanitary District for the year ending April 30, 1945, was entered by the Central States Sew. Wks. Assn. and was picked for the award in competition with entries submitted by four other associations.

1946 *Kenneth Allen Awards*

(For service to member associations)

Texas—E. J. M. Berg, Supt., San Antonio, Tex.



New Directors

A. F. Dappert
N. Y. State Dept. Health, Albany
(Dir. at Large)

R. J. Desmarais
City Engr.
Windsor, Ont.
(Canadian Inst.)

Iowa—Theodore R. Lovell, Ch. Engr., Thorpe Well Co., Marshalltown, Iowa.

Central States—George Martin, Supt., Green Bay, Wis.

Federal—Frank E. De Martini, San. Engr., U. S. P. H. S., Cincinnati, Ohio.

Wm. J. Orchard
Wallace & Tiernan Co.
Newark, N. J.
(Honorary Membership)

H. Heukelekian
Agri. Expt. Sta.
New Brunswick, N. J.
(Harrison Prescott Eddy Medal)

Honors and Awards

L. W. Van Kleeck
Conn. State Dept. Health
Hartford, Conn.
(George Bradley Gascoigne Medal)

F. W. Gilcreas
N. Y. State Dept. Health
Albany, N. Y.
(Charles Alvin Emerson Medal)

Willem Rudolfs
Agri. Expt. Sta.
New Brunswick, N. J.
(Honorary Membership)

Charles Alvin Emerson Award

(For service to the Federation)

F. Wellington Gilcreas,
Asst. Director,
Div. of Laboratories and Research,
N. Y. State Dept. of Health,
Albany, N. Y.

"Since 1941 Mr. Gilcreas has rendered invaluable service to the Federation as Chairman of the Publications Committee . . . as a member of the Sewage Works Practice Committee, as Chairman of a Chlorination

Michigan—Thomas J. Doyle, Supt., Pontiac, Mich.

New Jersey—John R. Downes, Supt., Plainfield, N. J.

Inst. of Sew. Purif.—John Henry Garner, Chief Inspector, Wakefield, England.

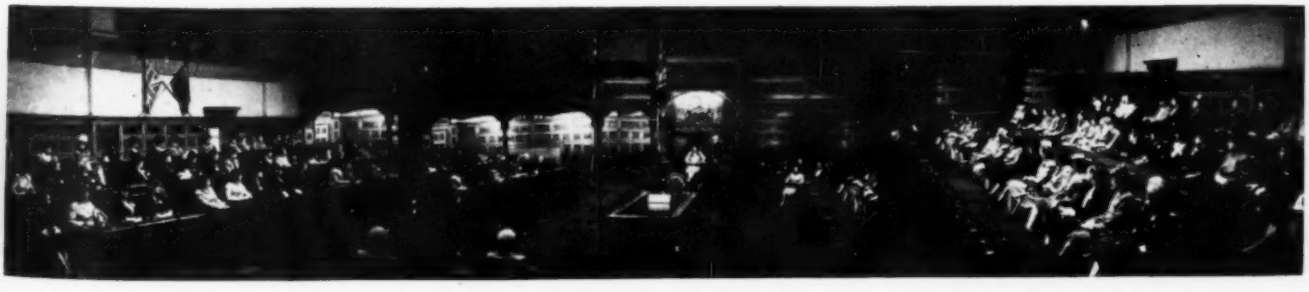
North Carolina—Harold Benedict Gotaas, Prof. San. Engr., Univ. of California, Berkeley, Cal.

Pacific Northwest—William P. Hughes, City Engineer, Lewiston, Idaho.

Honorary Membership

William John Orchard,
President and Gen. Mgr.,
Wallace & Tiernan Products, Inc.,
Maplewood, N. J.

The citation read "For his early guidance of the Federation in financial matters . . . his individual efforts in securing sufficient advertising pledges to insure success of the original quarterly journal; his service on the original committee of One Hundred and the Temporary Committee which launched the Fed-



The Ladies Occupying Members' Seats in the Parliament Chambers

In the speaker's chair is seated the Honorable Mary Elva Glendy Enslow of Virginia, picked by the Sergeant-at-Arms for the honor of being "Her Majesty for a Day."

(Note: Because of the dimness of lighting, the photographer was surprised that this film showed anything at all.)

eration in 1928; his 16 years of faithful service on the Board of Control as Director-at-Large, and his continuing active participation in the administration of the Federation as Chairman of the Finance Advisory Committee."

Past Presidents' Certificates

Past presidents' certificates were presented to Charles Alvin Emerson (first president), to the family of the late Arthur S. Bedell, to George Schroepfer, A. M. Rawn, Albert E. Berry, and John Kurtz Hoskins. Presentation of these certificates was made by Francis S. Friel, President Elect.

Mr. Emerson presented the Charles Alvin Emerson Awards, and Dr. William D. Hatfield presented the William D. Hatfield Award; all other 1946 awards were presented by President J. K. Hoskins.

Membership Prizes

The Federation Prize for the greatest percentage gain in membership went to the Oklahoma Sewage Works Assn., which showed a gain of 230 per cent during the year.

The prize for the greatest numerical gain in membership was won by the Canadian Sewage Works Assn., which won with a membership gain of 90 (it also won last year with a gain of 72). Runners-up were Ohio with 80, Pennsylvania with 70 and New York with 53 new members.

The annual Man-miles Cup given to the association which has the greatest mileage traveled by registrants at a Federation Convention, was won for the fifth time by the Central States Assn.

Toronto's Sewage Treatment

Addressing the opening session of the convention, **William Storrie**, of Gore and Storrie, Cons. Engrs., Toronto, presented the story of sewage treatment in Toronto from its earliest inception to the contracts now under way on a complete treatment that will involve the expenditure of some $15,000,000.

In a hundred years, Toronto has grown from a population of 10,000 to more than 700,000, and from an area of 9 sq. miles to 76 sq. miles, with a suburban population of 200,000. With three water plants and water purification and milk pasteurization practiced since 1910-11, the one-time typhoid death rate of 55 per 100,000 has dropped to nil, with but two deaths in the last six years. Little thanks for this record can be given to sewage treatment because except for one plant offering complete treatment to a population of 100,000 and another old plant offering partial treatment to 200,000, the city has had practically no sewage treatment.

Before the construction of new sewers, some 20,000 cu. ft. of sewage sludge were removed from the slips each year. A sedimentation plant from which the sludge is lagooned for periods of 18 months to two years and which discharges only two-thirds of the flow some 4600 ft. out into the lake, with the other third spilling over into Ashbridges Bay, is hardly good sewage treatment.

The present North Toronto Activated Sludge Plant is a forerunner of the final overall plant design. The new plant will be located near where the old partial treatment plant now exists, and within four years will embody complete treatment, although for the present it will consist of primary treatment and chlorination only. The new 9 ft. outfall will be 3300 ft. long and Mr. Storrie showed slides of how the outfall will be constructed.

The new plant, which will have six sedimentation tanks and four 100-ft. digestion tanks, is protected from erosion of the grounds by a 1385 ft. sea wall of the throw-back type. The work on the primary treatment plant will be completed early next year. Sewage concentrations in Toronto are generally higher than average concentrations in the United States, the suspended solids and B.O.D. content both being approximately 275 ppm.

SLUDGE DISPOSAL—A SYMPOSIUM

Scum Control in Digesters

"Scum is a problem when it interferes with uniform gas production, when it plugs pipe outlets, stops normal overflow, interferes with the withdrawal of tank contents, or when its volume greatly reduces available digestion capacity." So spoke **R. S. Rankin**, Manager, Sanitary Engineering Division, The Dorr Co., New York, N. Y., in opening his paper on "Scum Control in Digesters."

Materials which cause the formation of scum may be classified as follows:

1. Grease and oil.
2. Mat forming materials; fibres from textile mills, or hat factories, animal hair, paunch manure, fruit skins, etc.
3. Miscellaneous indigestible materials—twigs, bottle caps, matches, rags, etc.
4. Gas buoyed sludge.

Mr. Rankin suggests that scum problems may be handled in one of two ways: (1) Overcome the problem by prevention at industrial plants discharging scum forming materials, or (2) overcome the problem at the sewage plant.

An example of the first method is the removal of tannery hair by rotary fine screens. Similar ideas may be used in other types of industry causing trouble.

To attack the problem of scum control at the sewage treatment plant, one or more of several methods may be used: Maintaining the temperature of the scum layer at 95 to 100 deg. F.; recirculation of supernatant liquor; removal of the indigestible material from the surface of the tank by some mechanical means; or for gas buoyed sludge, scrubbing by agitation.

Construction of digesters affects scum formation and construction should make provision for drawing off materials which cannot be dissipated by other means. The type of roof affects scum formation; a submerged roof may be either fixed or floating, but a submerged roof is better to prevent scum formation than a cover that is not submerged.

Scum breakers and surface agitators have also been used to reduce scum formations.

Limited digester capacity is a serious cause of scum troubles, particularly if the storage capacity is less than 25 to 30 days. For this reason Mr. Rankin urged that designers provide liberal digestion capacity.

In discussing Mr. Rankin's paper, **H. E. Schlenz**, Vice President, Pacific Flush Tank Co., Chicago, Ill., said that types of scum encountered in digesters may be divided into two classes: nondigestible and digestible accumulations.

In the former class are seeds, match sticks, etc., industrial wastes typified by hair, and unsaponifiable greases such as mineral oils. In the latter class are gas lifted solids, saponifiable fats (and soaps) and solids buoyed by adherence to grease particles.

General characteristics of scum with which operators have to deal may be summed up as follows: High in volatile matter content (70 to 90 per cent); high in percentage of fats and soaps; low in moisture content (up to 25 per cent dry solids).

Although many operators hesitate to add scum or grease from sedimentation tank skimmings to diges-

ters, actually the digester is the best place to dispose of the material as long as it is digestible, for contrary to opinions of some years ago, grease is readily digestible, yielding a high methane content gas. As long as scum in digesters does not build up to depths of more than a foot or so, it does not interfere with the operation of digestion tanks.

This being the case, it is obvious that if proper conditions are provided in the scum mass, it is possible to promote the digestion of the material and control scum formation.

Control of scum may be accomplished in three ways: liquid saturation, control of temperature in the scum zone, and by ammonia nitrogen control.

Liquid Saturation of Scum. Scum may be saturated with liquid by positive submergence by an impervious structure of the materials which tend to float, thereby keeping the solids from drying out with gas. Another method of liquid saturation is to circulate supernatant liquor from below the scum layer to the top of the layer.

It is not necessary, nor is it desirable, to circulate this liquor to the top of the scum with any jetting force. Best results are accomplished by discharging the liquid over the surface of the scum at the central part of the tank in the gas dome. The rate of discharge should be such that the upper two-thirds of the digestion tank volume is recirculated in 24 to 48 hours.

Guests from Afar

Wm. I. Chamberlain, City Chemist, and Geo. R. Goffin, Asst. Manager & Engr., Dept. of Works, Brisbane, Australia (On a tour of American and Canadian plants)

Control of Temperatures in Scum Zones. Scum layers are usually lower in temperature than the body of the digesting sludge. If brought to normal temperature, digestion proceeds at a better rate and scum formations decrease. This increase in temperature of the scum layer may be brought about by recirculation (as above) or by applying an external source of heat to the scum layer.

Ammonia-Nitrogen Control. Plant scale experiments have shown that heavy scum formations may be softened by the addition of ammonium sulfate, in relatively small amounts, to the scum concentration. This ammonium sulfate added in amounts of 50 to 100 lb. as a concentrated solution actually causes a softening of the scum and an increased digestive activity with increased gas production. If added at too rapid a rate, foaming may result. One plant which uses this treatment regularly adds approximately 100 lb. whenever scum accumulations become excessive, about once every three months.

As yet no adequate explanation of the effect of ammonium sulfate on scum dissipation is available, but it is possible that the scum zone is deficient in ammonia nitrogen, a condition which may not always be corrected by recirculation. (Some of the procedures suggested by Mr. Schlenz are either patented or have patents pending; their use should be subject to permission.)

Incineration Problems

Perhaps the audience was expecting a delineation of operating problems in the paper of this title read by **George J. Schroepfer,** Professor of Sanitary Engineering, University of Minnesota, Minneapolis, Minn., but what they heard was an engineering report on the history, development, construction costs, operation costs, power requirements, fuel values, and some incineration problems.

Modern sludge incineration is only about 12 years old, but the first experiments on sludge burning were made as long ago as 1910. The first permanent installation for the incineration of sludge was in 1934 at Dearborn, Mich. (multiple hearth type), and in Feb. 1935 the second installation (flash-dryer) was made at Chicago's Calumet plant. There

Wm. Storrie, Cons. Engr., Toronto

R. S. Rankin, The Dorr Co., New York

Programmers

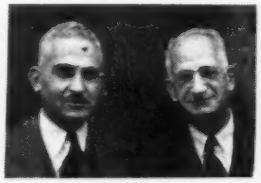
H. E. Schlenz, P. F. T. Co., Chicago

Geo. J. Schroepfer, Univ. Minnesota, Minneapolis

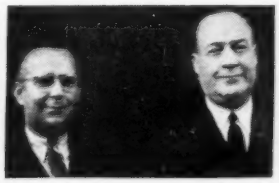
Mark B. Owen, Cons. Engr., Indianapolis

A. M. Boehm, Worthington Pump, New York

W. B. Marshall, Mgr. Sales Prom., Chain-Belt Co., Milwaukee, and David B. Lee, Chief Engr., Fla. Dept. of Health, Jacksonville, Fla.



Chas. E. Billion, Comr. of Pub. Wks. and William P. Gyatt, Supt. Sew. Disp'l, Syracuse, N. Y.



Richard S. Burr, Service Engr., Am. Brass Co., Waterbury, Conn., and Lee B. McMahon, "Water & Sewage Works" Cleveland, Ohio

C. T. Mudgett, Supt. Sew. Tr. Wks. Muskegon, Mich. and W. F. Shephard, Chf., Div. Swge. Dept. of Health, Lansing, Mich.

Edwin C. McKeeman, Supt., Sewage Treatment Wks., Freeport, L. I., and Frank H. Holland, Commr. of Works, Freeport, L. I.

are now 44 incinerators in 39 communities with a total capacity of 5972 tons of cake daily. More than a third of the plants are installed in cities with a population range of 20,000 to 50,000. Prof. Schroepfer estimates that approximately 20 per cent of the sludge produced in the country is incinerated.

Among the first questions asked about incineration were: Will it burn? Will it smell? Will there be a smoke nuisance, and what will it cost? In 12 years' experience, it has been shown that sludge will burn without odor or smoke, but the answer to the last question has not been so easy. Drawing on his own experience as former superintendent of the Minneapolis-St. Paul plant, Prof. Schroepfer made an analysis of factors affecting the cost of incineration. At Minneapolis-St. Paul, for example, the cost of operation and maintenance per ton of cake and of dry solids has been $0.42 and $1.26, respectively. Of these costs, 30.5 per cent was for maintenance. Operating costs (69.5 per cent of the total) were distributed 70 per cent to salaries and wages, 12.8 per cent to supplies, and 17.2 per cent to power and light. Compared to estimates and bids on hauling sludge to be buried of $0.60 per ton of cake, the $0.42 per ton for incineration is quite reasonable.

As might well be expected, Prof. Schroepfer has shown that the *cost of construction* per ton capacity has an inverse relation to the size of the installation. A ten ton per day incinerator will cost $2000 per ton capacity, while a 1000 ton per day unit will only cost $450 per ton capacity.

Operation costs are not easily determined on a generalized basis. Only seven plants have sufficiently detailed data to permit of comparisons. Prof. Schroepfer lists the costs as follows:

COST PER TON

	Cake Solids	Dry Solids
Average	$1.19	$3.71
Maximum	1.68	5.50
Minimum	0.38	1.12

In general, the installation of sewage sludge incinerators are more costly than garbage incinerators, but the cost of incineration of sludge is in the same relative range as is garbage.

On the matter of *fuel value of sewage sludge*, Prof. Schroepfer finds that actual observation has borne out the general relation between volatile matter content and Btu. value as developed experimentally by Fair and Moore in 1935. For raw sludge, $\text{Btu.} = (85P^{1.085} - 700)$, and for activated sludge, $\text{Btu.} = 69.2P^{1.085}$ where P = per cent volatile matter content. Because the volatile matter of raw sludge varies from 30 to 80 per cent and of digested sludge from 40 to 60 per cent, along with a wide variation in moisture content of sludge and sludge cake, it is obvious that the volatile solids in a pound of sludge cake may show a variation of 300 per cent in heat value of the cake, and this makes for complexity both in design and operation of incinerator units.

The variation in *supplementary fuel requirements* is from less than 1.0 per cent to 35 per cent with an average of approximately 15 per cent. For three plants of the flash dryer type the supplemental fuel requirement is 19.6 per cent, and for seven multiple hearth plants the requirement is 12.2 per cent. Supplementary fuel requirements for raw sludge incineration at two plants is but 1.75 per cent while for digested sludge (in four plants) the supplementary Btu. requirement is 17.9 per cent or ten times as much. This variation shows some of the considerations that must be given to evaluating various means of sludge disposal. One of the factors that must be considered in incineration is the amount of heat that must be furnished to evaporate the water in the sludge cake. Prof. Schroepfer has calculated that much of the supplemental fuel required over and above that furnished by the sludge itself is for water evaporation. In ten plants this requirement varies from 23 to 804 Btu. per pound of water evaporated.

In general, theoretical calculations confirmed by operation results indicate that (1) raw settled sludge can be incinerated without supplemental fuel, in fact, an excess of heat is usually available, (2) raw activated sludge requires supplemental fuel, and (3) digested sludge may or may not require supplemental fuel, depending on the degree of digestion and moisture content of the sludge cake.

Power requirements indicate that flash dryer type incinerators require 69.2 KWH. per dry ton of solids and multiple hearth incinerators require but 20.2 KWH. per dry ton. While these data were obtained from but four plants and must be evaluated in that light, it does appear that there is a difference in costs from $0.40 to $1.00 between the two types of incinerators.

Whether or not to digest before incineration is a matter that requires much consideration. In small plants the answer is probably yes, but for large plants, where the volatile matter in the sludge cake is fairly constant because the volatile matter content varies directly with the moisture content of the cake, the answer may be no! This is true because as volatile matter goes down in raw sludge the moisture content of the sludge cake goes down, and the volatile matter per ton of sludge cake remains fairly constant. Thus wide variations in operating conditions are not necessarily experienced.

Whether or not sludge should be filtered is a question that has yet to be fully answered. Prof. Schroepfer shows that if sludge could be concentrated to 85 per cent moisture, incineration of the liquid sludge would be economical. (Two small plants now incinerate liquid sludge at reasonable costs.)

Whether or not to *recover heat* is another moot question and will often depend on local conditions, power costs, etc. On the subject of *thermal efficiency versus simplicity* of design and operation, Prof. Schroepfer obviously favors the latter and cited figures to show that by eliminating preheaters in the Minneapolis-St. Paul furnaces, the power costs were reduced from 17 kwh. to 5 kwh. per ton at a savings of $6000 annually and an equal saving in maintenance and replacement costs. Additional heat was not required and the savings were more than four times the fuel cost per year.

While there seems to be a tendency to combine *garbage incineration* with sludge incineration, Prof. Schroepfer does not seem to be favorable to the idea.

On the matter of *drying versus burning*, Prof. Schroepfer said, "If sludge can be incinerated for $1 to $2 per dry ton, the decision to make a large expenditure in plant and to spend $15 or more per dry ton to make fertilizer, the value of which may fluctuate from $5 to $30 per ton over the years, is one which deserves thorough consideration."

In discussing Prof. Schroepfer's paper, **Mark B. Owen,** Cons. Engr. of Indianapolis, Ind., commented on the relation of air to incineration. The quantity of air admitted to the furnace is important; if too little, smoke results; if too much (and all incinerators allow for 25 to 100 per cent excess air) there is a loss of heat up the chimney.

Mr. Owen recommends the making of ultimate analyses of the sludge before designing the incinerator, because on the ultimate analysis actually depends the size of furnace, air requirement, and other important factors, such as water

Manufacturers' Luncheon

(The Canadian Assn., Hosts to the American Mfrs. Assn.)

(Presidents) *("King Salmon")* *(Wheel Horses*)*

"Bill" Sherwood, Pres. of the American, and George Gass, Pres. of the Canadian. *As decorated on the buffet luncheon table, a real work of art.* *Geo. Morgan (Victaulic), ent. chrm., and Charlie Taylor (Neptune), club room chrm.*

*[*An especial vote of appreciation is due Geo. Morgan and Charlie Taylor for the excellence of entertainment and their expert running of the club room.—Ed.]*

and ash content, heat loss of equipment, and so forth. The vacuum filters and digestion units should be operated at least six months before the incinerators are designed, according to Mr. Owen.

Sludge Heating in Digestion Tanks

In the absence of **Prof. Henry J. Miles,** Assoc. Prof., Civil Engineering, University of Southern California, Los Angeles, Cal., his paper on the "Evaluation of Sludge Heating Methods in Digestion Tanks" was read by **Dr. Willem Rudolfs,** who also discussed the paper.

Prof. Miles pointed out the factors peculiar to sludge digestion, remarking that the heat requirements vary at different stages of digestion, and that heat is required to heat the sludge up to the level of tank contents and to maintain temperature. Prof. Miles also warned not to use any type of heating equipment which makes possible introduction of an open flame or a hot surface approaching ignition temperature, and not to use a method that raises the temperature too high for the bacteria.

As to the basic principles of heat exchange, Prof. Miles said that heating was by convection and conduction, and that the transfer of heat from the metal wall to the sludge involves conduction of the wall, conduction of the scale (scale coefficient), conduction of intermediate film (film coefficient), and conduction of the sludge itself. The quantity of heat required to raise the temperature of the sludge to a given level is a function of the specific heat of the sludge, which varies with the type of sludge, concentration, and degree of digestion.

From considerations of these fundamental factors, it appears that sludge is about the same as water, except for the low film coefficient, and the problem in heating sludge, therefore, is largely to find methods for overcoming this sludge film bottleneck.

Methods for heating sludge digesters include the introduction of heat directly into the sludge tank or heating the sludge outside of the tank. Heaters within the digester include horizontal water coils, vertical hot water coils, submerged gas burners (open and closed types), radiant heating, and steam and hot water direct heating. Heaters outside of the tanks include addition of steam to the raw sludge and hot water heat exchangers.

Advantages and disadvantages of each type of heating were discussed with those for external heating seeming to have the most benefits. There is more heat transfer per foot of surface, accessibility to the heating unit is particularly advantageous, and external heating units avoid sudden drops in temperature accompanying changes in gas production, and vice versa.

In his discussion of the paper, **Dr. Rudolfs** mentioned scale formation on heating coils wherein the water temperature was above 130 deg. F. on direct heating, on thermophylic digestion, and on heat losses of exposed tanks versus those protected by earth embankments.

Dr. A. E. Berry read some comments from **A. M. Rawn,** Gen. Mgr., Los Angeles County Sanitary Dist., who introduced direct heating with steam and still favors that method. **Walter Sperry,** Supt. of Aurora (Ill.) San. District, confirmed the statement that scale forms on hot water coil heaters above 130 deg. F.

Chas. Lamb, Mayor Lindsay, Ont. and Mrs. Lamb

Paul Molitor, Supt. Sewage Treatment Wks. Rutherford, N. J. and Mrs. Molitor

Mrs. M. Le Bosquet (Cincinnati) Mrs. J. K. Hoskins (Washington) Mrs. C. C. Ruchhoft (Cincinnati)

P. N. Daniels (Director) Supt. Sewage Works Trenton, N. J. and Mrs. Daniels

Mark B. Owen Cons. Engr. Indianapolis and Mrs. Owen

Comments were also made from the audience on the open and closed flame direct heating system as developed by Keefer at Baltimore (*Water and Sewage Works,* Aug. 1946).

Sludge Gas Utilization

In the paper, "Present Status of Sludge Gas Utilization," prepared by **Richard H. Gould,** Dir., Div. of Engr., Dept. of Public Works, New York City, and read by **Dr. Gail P. Edwards,** Director of Laboratories of the N. Y. Dept. of Public Works, the subject matter was confined to

Directors

John W. Pray Supt. Wtr. & Swg. Fort Dodge, Ia.

Geo. S. Rawlins Cons. Engr. Charlotte, N. C.

D. K. Matter San. Engr. Harrisburg, Pa.

Ralph E. Fuhrman Supt. Sewage Wks. Washington

experiences in New York City over the past ten years. Digestion and sludge gas utilization is but one of several alternate methods that may be available for the disposal of sludge, and the choice of method will depend on the local conditions involved in the problem.

In New York City the trend has been definitely toward the digestion of sludge and use of gas; four plants now utilize sludge gas for heat and power and one for heat only. Barging of sludge to sea has been the most economical method of disposal at New York because of its location on the ocean, but even that cost of $2.64 per ton of dry solids will be reduced by digestion of solids first.

New York City embarked on sludge digestion as a means of disposal in 1936, and Mr. Gould's paper reviewed the history of the various installations of digesters and sludge gas engines. Gas produced at the different plants varies from 75 to 91 per cent of the power and heat demand.

New installations will utilize larger digestion tanks, and following the successful operation of the dual fuel engine at Tallmans' Island Plant, future installations of power units will use the dual fuel engine. This type of engine, which uses about 5 per cent pilot oil to ignite the gas and may be used on any combination of gas and oil percentages, produces more power per cu. ft. of gas produced. With approximately 25 per cent more power produced, the gas will go farther and in most cases stretch the supply of gas to the point where it will meet all of the power requirements of the plant without the necessity to purchase auxiliary fuel or power.

The discussor of Mr. Gould's paper was **A. M. Boehm,** Engine Division, Worthington Pump and Machinery Corp., New York, N. Y. Mr. Boehm explained more fully how the dual fuel engine works on the diesel cycle, producing more power, how the dual fuel engine can operate on any combination of gas and oil, how turbo-charging produces even more power, obtaining 36 per cent of the useful heat in the gas.

Higher compression can be obtained with sludge gas but the presence of large amounts of carbon dioxide slows ignition and flame propagation, thus requiring a small amount of fuel oil as a pilot.

Mr. Boehm closed his discussion with slides of various installations and of curves showing the benefits in power production from this type of engine.

Entertainment

Prior to the opening of the technical sessions, a great number of persons had gathered and registered on Sunday. For the entertainment of the members of the Board of Control and these early registrants, Sunday evening was given over to a choral concert by the Leslie-Bell Singers of Toronto, a very talented group of girls whose combined artistry and whose individual soloists gained rapt attention, hearty applause, and sincere admiration.

Following the opening session on Monday morning, the Federation held its annual luncheon, at which the speaker was **Dr. J. T. Phair,** Deputy Minister of Health of Ontario. Dr. Phair spoke on "Environmental Sanitation in the Field of Public Health."

In regard to this matter, Dr. Phair said that public leaders are either wrong, misleading, or too enthusiastic, for the people have no faith in politicians, engineers or health officers, and remember only the mistakes made by each of them. The interest of the public in environmental sanitation generally follows this listing of items in order of importance: communicable disease, sewage and refuse disposal, water supplies, dirt and odor as visible yardsticks, municipal pride, and hygiene.

Monday evening saw a dinner attended by more than six hundred guests. At this dinner the speaker was **Hon. Russell T. Kelley,** Provincial Minister of Health of Ontario, who proved to be an entertaining speaker. Following the dinner several acts of vaudeville entertained the assembled guests.

Outstanding were a couple with marionettes, and a very clever ventriloquist who used not only two dummies but also gave a unique demonstration of singing for a stooge who mouthed the words. The very excellent stooge who took over on but a moment's notice was none other than **W. J. "Bill" Orchard,** of Wallace and Tiernan Co.

The following day, Mr. Orchard proved his versatility by giving the luncheon address at the brief meeting of the Canadian Institute on Sewage and Sanitation. Mr. Orchard declared that "Recorded, identified public works in the water and sewage field listed for early development throughout North America now total seven times the largest total schedule drawn up in pre-war years. This vast total of work on which public health depends," Mr. Orchard told more than 300 guests, "will call for the utmost effort in the coming decade or two by our manufacturers of equipment and contractors. This development will also call for a great increase in engineers, trained operators, and personnel and works."

This session was also addressed by Pres. of the Canadian Inst., J. S. Nicklin, City Engineer of Guelph, Ont.; by Dr. A. E. Berry, Secy. of the Institute; by Pres. Elect F. S. Friel of the Federation, by Secy. of the Federation W. H. Wisely, and by the Federation President, Adm. J. K. Hoskins, who presented a certificate of appreciated service to R. J. Desmarais of Windsor, Ont., as retiring president of the Institute.

The annual Federation Banquet and Dinner Dance was held on Tuesday night. It was at this dinner that the presentation of the awards was made. Club room type of entertainment preceded and followed each of the programmed meals.

(The concluding installment of this report will appear in the December issue.)

Public Health Service Grants-in-Aid for Research in Environmental Sanitation

The National Institute of Health of the U. S. Public Health Service has a fund to distribute for grants-in-aid for research in medicine and public health. Fourteen subcommittees or study sections have been appointed by the Institute to stimulate research projects and pass on applications for grants-in-aid for research. The sanitation study section is the subcommittee which deals with all projects in the various fields of sanitary engineering. Grants for research in problems of water supply, sewage disposal, industrial waste treatment, sanitary bacteriology and chemistry, stream pollution, atmospheric pollution, housing sanitation and ventilation, and other fields of sanitation may be made.

Universities, laboratories, and individuals may apply for research grants-in-aid. Additional information and application forms may be obtained by writing to the Research Grants Division, National Institute of Health, Bethesda 14, Md.

DENSITY CURRENTS IN FINAL SETTLING TANKS

Studies at Activated Sludge Plant Indicate New Solution to Problem

By STEPHEN R. KIN
Assoc. Sanitary Engineer
CAMP BUTNER, N. C.

ANDERSON[1] defines density current as a "gravity flow produced in one fluid by another of slightly greater density seeking the lower level." These currents are observed in the final settling tanks of activated sludge plants. The mixed liquor acts as a liquid of a greater density than the clear liquor in the tank. The mixed liquor plunges to the bottom of the tank and then flows along the bottom away from the inlet. This induces a circulating current in the clear liquor of the tank. The circulating current is characterized by a downward flow near the mixed liquor inlet; forward flow in the bottom portion of the clear liquor; upward flow near the discharge end of the tank; and backward flow in the top portion of the liquor.

The upward flow takes along with it the light flocculent solids. Some of these solids escape with the plant effluent, giving reduced plant efficiencies. The remainder of the lifted solids are carried by the backward flow toward the inlet end of the tank and to some extent settle as they travel. The clearest liquor will be found near the surface of the tank between the inlet end and about 70 per cent of the distance toward the effluent end. The up-flow zone exists in the last 10 per cent of tank length.

The Author

Solids will not settle in this zone, yet, in the conventional tank, the effluent weirs are located in this area.

In the Bowery Bay Plant in New York City, an attempt was made to correct this condition. The effluent weirs were placed along the sides of the rectangular tank for about 40 per cent of the distance from the effluent end. Also, the point of sludge withdrawal was placed at the end opposite to the incoming flow. The normal direction of the motion of the sludge scraper mechanism was reversed. Gould[2] showed that the Bowery Bay Plant, on the basis of sewage flow, has only 57 per cent the tankage of the Ward Island Plant, which does not have these changes, and yet the results of the two plants are comparable.

Townsend[3] favors the use of multiple inlets rather than a concentrated point of inlet, and low inlet velocities as aids in minimizing the density currents. Anderson and Townsend are in agreement that it is desirable to avoid the zone of upward flow for the location of the effluent weirs.

Final Settling Tanks At Camp Butner

Each of the five final settling tanks at Camp Butner is rectangular in shape, has a capacity of 60,000 gal. and has a surface area of 780 sq. ft. (See Fig. 1). The sewage plant was designed on the basis of 70 gallons per capita flow at full post strength. Actually the sewage flow amounts to about 50 gallons per capita when the post is nearly fully occupied. The unexpected low flows give the tanks a greater capacity and longer detention periods, which proved beneficial for the sludge of high index, approximately 300 (Mohlman), which appears to be normal for this sewage.

This activated sludge also calls for high rates of sludge return. Luckily, the plant has ample capacity for sludge return. Rates of 100 per cent are commonly used. This high return rate requires less attention on the part of the operator and insures the rapid removal of the sludge from the final tank.

FINAL SETTLING TANK

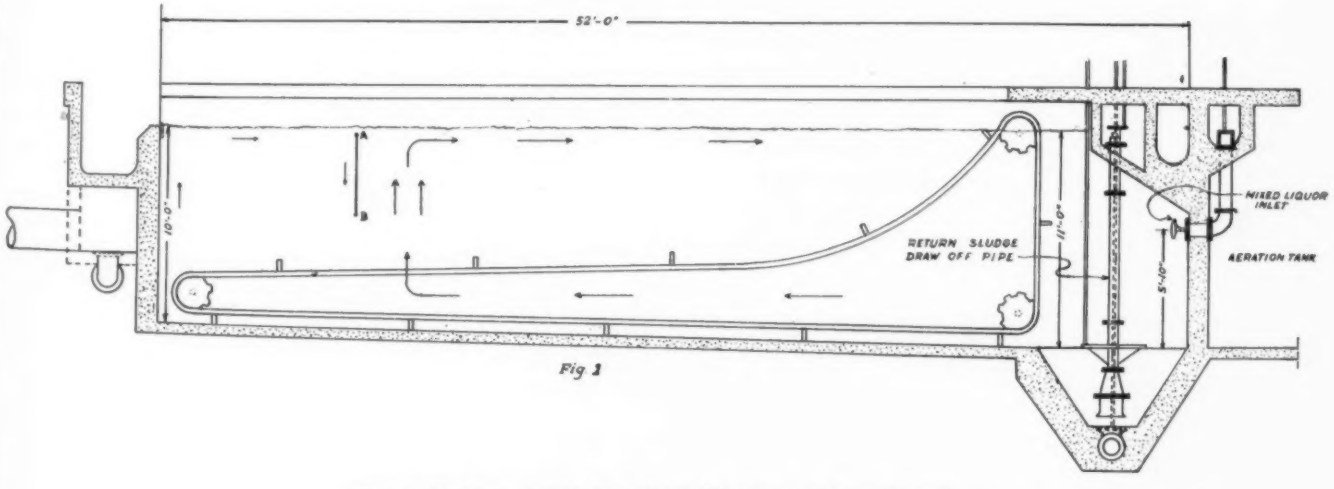


Fig 1

Fig. 1. Design of Final Settling Tanks at Camp Butner.
(Note: Baffle A-B was installed for experimental studies—Arrows indicate currents with baffle installed).

TABLE I

Month	Sewage Flow mgd.	Mixed Liquor Flow mgd. Calculated	1,000 Gal. Per Foot Weir Per 24 Hrs.	Gal. Per Sq. Foot Per 24 Hrs. Based on Mixed Liq. Flow	Susp. Solids Return Sludge	Susp. Solids Mixed Liquor
March, 1943	1.375	2.56	20.4	760	2,320	1,100
April	1.210	2.47	20.2	800	2,640	1,360
May	1.079	2.25	18.4	750	1,900	1,000
June	1.615	3.03	22.4	803	1,400	660
July	1.611	3.23	21.9	840	1,820	920
August	1.864	3.45	30.3	1,080	1,830	850
September	1.908	3.87	26.5	1,020	1,740	890
October	1.665	3.61	24.7	1,030	1,890	1,030
November	1.450	2.74	23.1	850	2,130	1,020
January, 1944	1.516	3.04	26.6	1,020	2,050	1,090
February	1.689	3.30	26.2	970	2,250	1,250
March	1.706	3.57	22.8	910	2,750	1,440
April	1.775	3.68	29.6	1,190	2,460	1,290
May	1.175	2.26	24.5	910	2,310	1,120
June	1.805	3.45	35.4	1,300	2,250	1,090
July	2.102	4.01	30.5	1,130	1,770	860
Average	1.597	3.16	25.2	960	2,094	1,061

Studies on the final tanks were started in the spring of 1944 by Ackerman, the former Sanitary Engineer. In one of the tanks, Ackerman installed a trough-like weir, Fig. 2. This increased the weir length from 15 feet to 125 feet. This tank then produced a better effluent than any of the other tanks. The upward flow, however, at the effluent end was just as strong as before.

Baffles No Help

In the late summer of 1944 the studies on the tanks were taken over by the author. The first attempt to reduce the circulating currents was made through the use of baffles. Baffles of various sizes and shapes were placed in different positions over the mixed liquor inlets. No improvement could be noted in the reduction of the upward flow. Some of these arrangements actually appeared to increase the suspended solids concentration in the final effluent. One of these arrangements in particular was a box built over each inlet with a series of holes in the box intended to give low inlet velocities through each hole and a maximum dispersion of the mixed liquor into the final tank.

Baffles were also installed near the bottom of the tank in several different locations just above the lower sludge rakes. These baffles served only as hurdles for the currents to leap and appear as upward flow just above the baffles. These changes resulted in a poorer final effluent.

Another location of baffles was in the upper portion of the tank. It was reasoned that if the return flow could be reduced there would be that much less forward flow in the lower portion of the tank. In Fig. 1, A-B is a sheetmetal baffle extending across the tank. The top of the sheetmetal is approximately three inches below the surface; the bottom is three feet lower. This arrangement resulted in unexpected currents, Fig. 1. The upward flow for the most part was located just ahead of the baffle. This resulted in an improved effluent but still left much to be desired.

TABLE II

Month	B.O.D. Raw Sewage ppm.	B.O.D. Final Effluent ppm.	B.O.D. Removal Pct.	Susp. Solids Raw Sewage ppm.	Susp. Solids Final Effluent ppm.	Susp. Solids Removal Pct.	Sludge Index (Mohlman)
1943—							
March	446	56	87.4	432	56	87.0	388
April	498	61	87.7	472	31	91.3	333
May	530	57	89.2	381	28	92.6	628
June	387	29	92.5	319	15	95.2	392
July	373	27	92.4	308	17	94.4	120
Aug.	342	45	86.8	262	14	94.6	128
Sept.	406	39	90.3	303	16	94.7	436
Oct.	455	55	87.9	334	25	92.5	418
Nov.	418	65	84.4	363	27	92.5	682
1944—							
Jan.	359	25	93.0	341	34	90.0	677
Feb.	372	15	96.0	387	17	93.0	378
March	387	35	91.0	394	14	96.4	281
April	388	58	85.1	327	29	91.1	280
May	316	44	86.1	290	22	92.4	260
June	345	41	88.1	285	31	89.2	303
July	333	35	89.5	297	22	92.6	572
Average	397	43	89.2	342	25	92.5	392

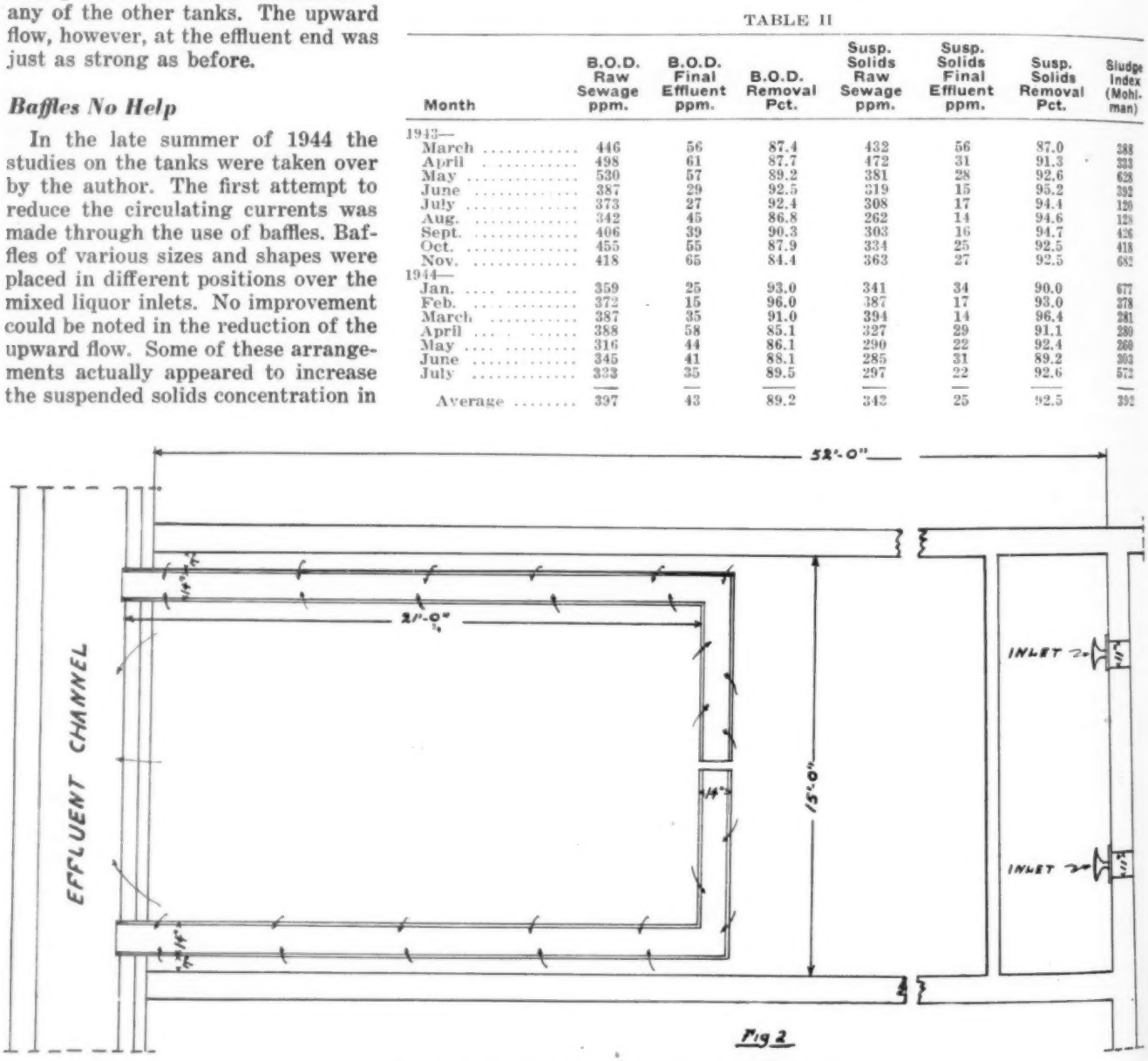


Fig. 2. Final Settling Tank with Extended Weir.

Dropped Inlets

The inlets to each of the final settling tanks are two openings, each 8 in. in diameter. The openings were protected by circular diffusing baffles. The openings are 5 feet 10 inches above the floor of the tank. Fig. 1 shows the original inlet arrangement. The baffles were removed and in their place were installed conduits made of sheetmetal. These conduits, Fig. 3, lowered the mixed liquor inlets and reduced the inlet velocities. Fig. 4 shows the installation. The author would have preferred to extend the conduits farther away from the inlet wall and to drop the inlets farther, but the position of the sludge scraper mechanism for the sludge hoppers prevented.

Comparison of Data

Tables I and II give the plant data for the period prior to the lowering of the inlets. Tables III and IV are for the period following the change. Actually, the change was not completed until the latter part of December, 1944. Approximately 25 per cent and 15 per cent of the flows were served by the original inlets during November, 1944, and December, 1944, respectively. It is to be noted that the data for December, 1943, in Tables I and II and February, 1945, in Tables III and IV are omitted. These two months showed suspended solids removals lower than usual, but for causes other than final settling tank design.

From about March, 1944, to January, 1946, the No. 4 final settling tank served approximately 25 per cent of the flow. This tank has a weir length of 125 feet. However, for the purpose of calculating the weir flows for column 4 of Tables I and III, the weir length is taken as 15 feet, the same as for the other tanks.

The data in Tables I through IV indicate an improved final effluent after the installation of the dropped inlets. In order to obtain a comparison under nearly the same conditions, the dropped inlets were removed from tank No. 5 and the original circular baffles were put back in place.

In Table V, Group A represents a fourteen-day run where samples of the final effluents of tanks Nos. 1, 4 and 5, collected every two hours and composited according to flow to make daily samples. Occasional sludge depth readings were made and in nearly all instances the readings showed the depth to be less than one foot, which is the minimum recordable depth for the sludge depth sampler used. These readings were made at points midway between the inlets and outlets of the tanks.

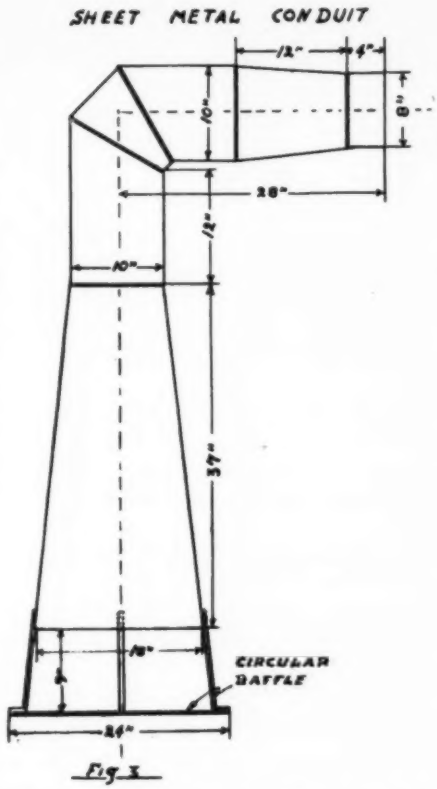


Fig. 3. Sheet Metal Conduit Installed to Drop Final Tank Inlets.

Group B represents a six-day run. The samples were collected hourly for an eight-hour day. Sludge depth readings were made hourly and in no case did they show sludge depth to a foot or more. This is recorded in Table V as 6 in. Group C represents a three-day run. Composite samples and sludge depth readings were made as for Group B. An effort was made to maintain an equal flow and sludge withdrawal for each tank in service. This was difficult to do. It is probable that at one time or another during the tests one tank received as much as thirty per cent greater flow than another tank. The same may be said for the sludge withdrawal rates.

The data in Table V indicate that tanks 1 and 4 give better solids removals than tank No. 5 (with the original inlets) and that when the sludge blankets are between one and three feet in depth, tank No. 1 shows a considerable better effluent than tank No. 5.

It had been observed that with the original inlets, no definite conclusions could be reached as to any change in the character of the final effluent with an increase in the sludge depth up to the six foot mark. At this mark the inlets were below the surface of the sludge blanket and the effluent was exceptionally free of solids. From the eight foot sludge depth

TABLE III

Month	Sewage Flow mgd.	Mixed Liquor Flow mgd. Calculated	1,000 Gal. Per Foot Weir Per 24 Hrs.	Gal. Per Sq. Foot Per 24 Hrs. Based on Mixed Liq. Flow	Susp. Solids Return Sludge	Susp. Solids Mixed Liquor
November, 1944	1.600	2.71	23.7	770	3,130	1,300
December	1.529	2.70	23.7	800	3,370	1,490
January, 1945	.925	1.67	22.8	790	4,040	1,490
March	1.140	1.96	25.3	850	5,050	2,120
April	1.124	2.17	22.1	830	3,850	1,870
May	1.394	2.97	23.2	950	3,570	1,900
June	1.638	3.06	27.3	980	3,920	1,830
July	1.630	2.95	27.2	960	3,570	1,600
August	1.461	2.77	23.2	850	3,100	1,470
September	1.858	3.49	27.6	990	3,760	1,770
October	1.278	2.76	19.1	750	3,910	1,960
November	1.115	2.20	15.8	610	3,270	1,610
December	1.418	2.56	23.6	830	5,560	2,480
January, 1946	1.135	2.18	18.9	700	3,690	1,770
Average, Table III	1,382	2.58	23.1	833	3,842	1,789
Average, Table I	1.597	3.16	25.2	960	2,094	1,061

TABLE IV

Month	B.O.D. Raw Sewage ppm.	B.O.D. Final Effluent ppm.	B.O.D. Removal Pct.	Susp. Solids Raw Sewage ppm.	Susp. Solids Final Effluent ppm.	Susp. Solids Removal Pct.	Sludge Index (Mohlman)
November, 1944	460	37	92.0	360	34	90.6	381
December, 1944	439	52	88.2	362	41	88.7	273
January, 1945	250	25	90.0	249	28	88.8	197
March, 1945	244	25	89.8	208	9	95.7	278
April, 1945	284	17	94.0	236	19	91.9	452
May, 1945	294	12	95.9	244	4	98.4	470
June, 1945	312	8	97.4	240	5	97.9	435
July, 1945	255	16	93.7	255	6	97.6	230
August, 1945	254	20	92.1	208	10	95.2	165
September, 1945	327	11	96.6	240	17	92.9	524
October, 1945	375	13	96.5	244	4	98.4	290
November, 1945	444	15	96.6	273	6	97.8	222
December, 1945	237	14	94.1	201	11	94.5	224
January, 1946	279	15	94.6	198	7	96.3	190
Average, Table IV	318	20	93.7	251	14	94.6	309
Average, Table II	397	43	89.2	343	25	92.5	392

TABLE V

Group		1,000 Gal. Per Foot of Weir Per 24 Hours: Tanks 1* and 5‡	1,000 Gal. Per Foot of Weir Per 24 Hours: Tank 4†	Gal. Per Sq. Ft. Per 24 Hr. Based on Calculated Mixed Liquor Flow	Sludge Index (Mohlman)	Return Sludge Susp. Solids ppm.	Mixed Liquor Susp. Solids ppm.	Depth of Sludge Blanket	Final Effluent Susp. Solids ppm.: Tank 1	Tank 4	Tank 5
A	Avg.	23.7	2.8	930	212	3,330	1,630	..	9.1	8.4	18.9
	Max.	31.3	3.7	1,110	293	3,760	1,730	..	17.0	16.0	32.0
	Min.	14.8	1.8	760	158	2,990	1,500	..	1.0	1.0	7.0
B	Avg.	28.5	..	990	102	2,670	1,280	6"	9.2	...	17.3
	Max.	38.0	..	1,120	107	3,010	1,500	6"	12.0	...	21.0
	Min.	20.7	..	760	91	2,310	1,100	6"	7.0	...	8.0
C.	Avg.	16.0	..	700	404	2,360	1,510	1.5'	2.7	...	28.0
	Max.	18.0	..	730	423	2,430	1,580	3.0'	4.0	...	32.0
	Min.	15.5	..	680	384	2,280	1,410	1.0'	2.0	...	25.0

*Tank No. 1 has the dropped inlets and 15 feet of weir.
†Tank No. 4 has the dropped inlets and 125 feet of weir.
‡Tank No. 5 has the original inlets and 15 feet of weir.

mark upward, the solids in the final effluent increased. This probably was due to the high forward velocities of the clear liquor in the tank picking up solids from the sludge blanket. The sludge blankets of six to eight feet gave such fine effluents that some thought was given to operating final tanks in such manner. The unstability of the sludge, which at times was given to denitrification, however, precluded any operation which gave a long detention period in the tanks.

In the tanks with the dropped inlets, it was found that when the sludge was less than a foot in depth, the circulating currents, although still present, were of lesser intensities than those in the tank with the original inlets. When the sludge blanket was more than one and a half feet deep, the surface of the sludge blanket was above the openings of the inlets, and there were no reverse currents when the mixed liquor flows into the tank were less than approximately 1,000 gal. per square foot of tank. Above this rate of flow, the reverse currents might or might not appear, but when they did, they were in much reduced intensity. Somewhat the same condition was observed in the tanks with the original inlets when the sludge was more than six feet deep; in other words, above the inlets.

In table VI the data shows a comparison of the velocities obtained in the upper parts of the clear liquor portions of two tanks, one in which the openings of the dropped inlets are below the surface of the sludge blanket and the other in which the original inlets are above the sludge blanket. Velocities for only the upper parts of the tanks are used since these are obtained without the interference of the sludge rakes, and yet serve the purpose of comparison. It is in these upper parts of the tanks where the backward flows are normally located. Velocities of backward flows are marked with the minus sign. In tank No. 5, run 2 was made fifteen minutes after run 1, but the respective velocities for the two runs differ considerably. The inability to obtain duplicate readings for velocities under what appear to be similar conditions suggests the need for further study of the factors involved. It is with some apprehension that Table VI is presented.

Effect of Dispersion of Mixed Liquor in the Final Tank

One point that has not been mentioned is the effect of dispersion of the mixed liquor in the clear liquor of the settling tank. When the mixed liquor has to fall a considerable distance before it reaches the bottom of the tank or the surface of the sludge blanket, some of the sludge floc separates from the mass of the mixed liquor and no longer presents the same settling properties. The same is true when inlet velocities are high.

The author believes that it is these solids, rather than the solids from the sludge blanket that are picked up by the upward flows. To demonstrate this theory, 10, 20, 50, 100 and 1,000 ml. of mixed liquor were put into five 1,000 ml. beakers. The volumes were brought up to 1,000 ml. each with distilled water to the first four beakers. The liquors were then gently stirred and allowed to stand for thirty minutes. Then, from just below the surfaces, samples were taken and suspended solids were determined. Five runs, each on different days, were made. Only in run No. 2 did the suspended solids of the clear liquor portion of the beaker, which had the undiluted mixed liquor (1,000 ml. mixed liquor), appear greater than any other determination in the same run. The author interprets this to mean that the solids in the sludge blanket or in the mixed liquor are interlocked and present some resistance to movements by currents. Once the floc particles are separated from the mass, however, they are at the mercy of the slightest current. In other words, for currents of the same velocities, the amount of solids in the clear liquor portion of the tank will increase with the increase in dispersion of the mixed liquor.

TABLE VI

Feet Below Surface	Tank No. 1 With Dropped Inlets Velocity in Feet Per Minute: Run 1	Run 2	Calculated	Tank No. 5 Original Inlets Velocity in Feet Per Minute: Run 1	Run 2	Calculated
1.0	.22	.64	.16	—.72	—1.00	.18
2.5	.16	.22	.16	—.82	—1.82	.18
4.0	.18	.18	.16	.94	— .44	.18

Sludge blanket tank No. 1—1.5 ft. in depth. Sludge blanket tank No. 5—2.5 ft. in depth. Tank flow approximately 15,300 gal. per foot of weir and 600 gal. per sq. ft. of tank. Sludge index 410—Return solids 2,530 ppm. Mixed liquor solids 1,250 ppm. Calculated velocity is the forward velocity for the cross section area of the clear liquor portion of each tank. In tank No. 1 it is based on 230,000 gal. per day final effluent flow and 9 ft. x 15 ft. area; in tank No. 5 230,000 gal. per day and 8 ft. x 15 ft. area.

TABLE VII
Suspended Solids

Run	Ml. Mixed Liquor* 10 ml.	20 ml.	50 ml.	100 ml.	1,000 ml.
1	7	16	14	14	4
2	1	11	27	34	17
3	1	10	23	16	1
4	1	4	2	9	1
5	2	8	10	14	1

*Mixed liquor suspended solids varied from 960 to 1,500 ppm. for the five runs.

Circulating Currents

For a better understanding of the forces behind the circulating currents the author suggests the equation:

$$x = 8.34 \text{ gpm. } (S_1 - S_2)\ h$$

where

x = work available to maintain circulating current, expressed in foot pounds per minute.

gpm. = rate of flow of the mixed liquor into the tank.

S_1 = specific gravity of the mixed liquor.

S_2 = specific gravity of the clear liquor in the tank. Actually this would be the weighted average specific gravity of the liquor in the tank from the inlet elevation to the elevation in the sludge blanket where the density of the sludge is equivalent to the density of the mixed liquor.

h = distance in feet from the mixed liquor inlet elevation to the elevation in the sludge blanket where the density is equal to that of the mixed liquor.

From the above equation it can be seen that when "h" is reduced to zero the value of "x" is also reduced to zero and no longer is energy available because of the favorable position, with respect to elevation, of the inlets to induce circulating currents.

Another set of conditions which is favorable to circulating currents exist

when the mixed liquor builds up on the sludge blanket, near the inlets. This may happen whether the inlets are above or below the surface of the sludge blanket, until the proper slope is established to allow gravity flow of the mixed liquor away from the inlet end of the tank. The distance the mixed liquor travels before it finally is absorbed by the sludge and the velocity of its travel are functions which add to circulating currents. These functions are affected by the sludge index (which, in a manner of speaking, is the rate of dewatering of sludge), the mixed liquor rate of flow, the solids concentration of the mixed liquor and the shape of the settling tank.

The result of these two functions, in the author's opinion, affects the circulating currents to a lesser extent than does the "h" factor in the equation just mentioned, but, nevertheless, deserves attention.

One method that can be used to minimize the effect of the mixed liquor travel is through the use of multiple inlets as suggested by Townsend.[3] With multiple inlets so spaced that each inlet serves an equal area through the center of gravity of that area, the resulting forces would not be additive since all travel would not be in one direction.

This discussion pertains to rectangular final settling tanks, but the author sees no reason why the inlets to circular tanks or square tanks cannot be lowered to the sludge blanket level and the velocities of circulating currents thus reduced.

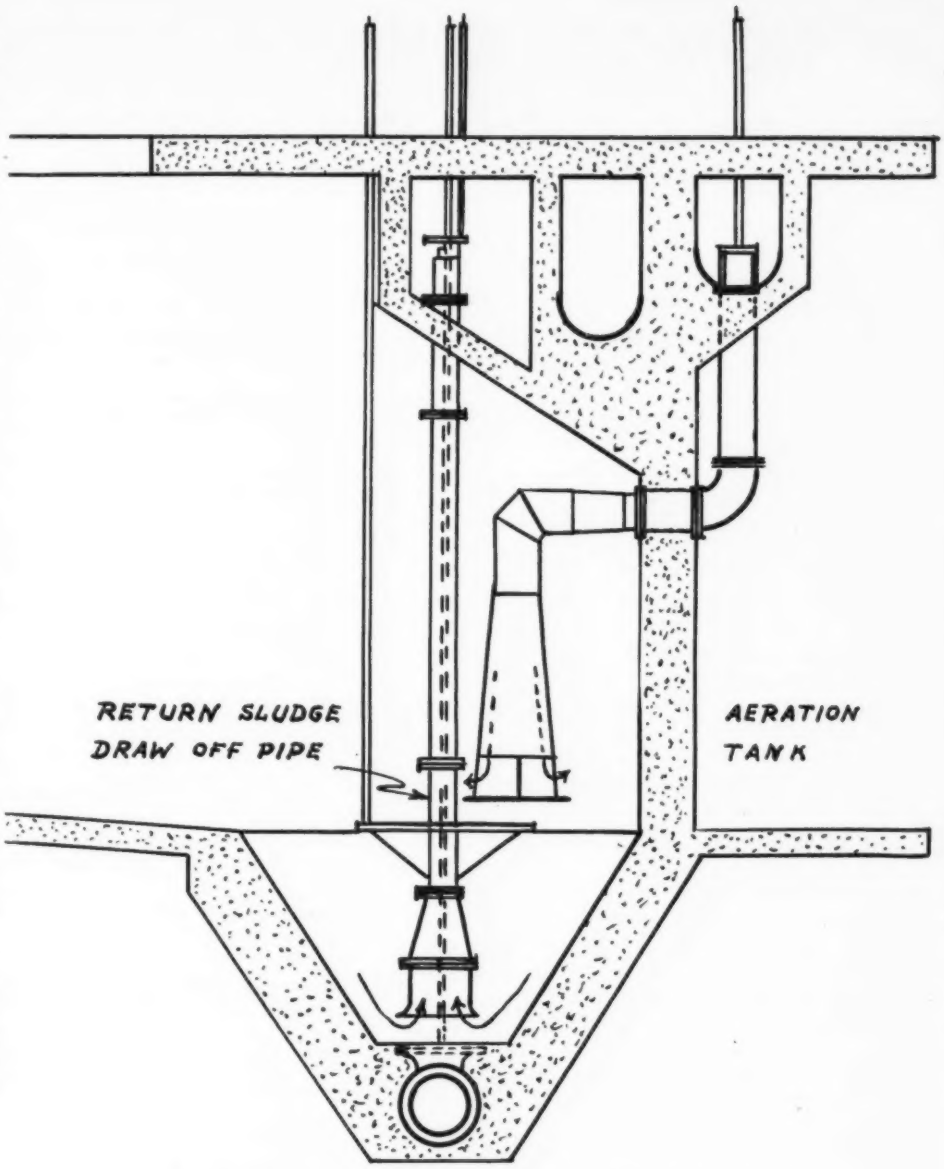


Fig. 4. Final Settling Tank with Dropped Inlet Installed.

Summary and Conclusion

The studies on the final settling tanks at this plant show that improved operation results were obtained by the use of extended weirs similar to those used by Gould. A further improvement was obtained by dropping the inlets into the tanks. When the openings of the dropped inlets are below the surface of the sludge blanket, the improvement is even more pronounced.

The inlets to the tanks should also be so designed as to present the minimum amount of mixing of the mixed liquor with the clear liquor of the tank in order to prevent the separation of the floc particles from the mass of sludge or mixed liquor solids. Such separated floc particles exhibit poorer settling properties than does the mass of mixed liquor solids.

References

1. "Design of Final Settling Tanks for Activated Sludge," by Norval E. Anderson. *Sewage Works Journal*, Vol. XVII, No. 1, January, 1945, p. 50.

2. "Improved Final Settling Tanks at Bowery Bay," by Richard H. Gould. *Civil Engineering*, Vol. 13, No. 6, June, 1943, p. 279.

3. "Design of Final Settling Tanks for Activated Sludge." A discussion by Darwin W. Townsend. *Sewage Works Journal*, Vol. XVII, No. 4, July, 1945, p. 803.

Michigan Planning Commission Reports Water Projects

The Michigan Planning Commission, which has been granting funds to municipalities for the preparation of plans, has issued a report on the status of applications on file for Water Improvement Projects as of Sept. 10, 1946.

Out of 170 applications on file, plans have been completed on 97, and final plans are under way (10 to 90 per cent complete) on 42 more projects. Preliminary plans have been filed on five projects and no report is available on 26.

The types of projects include permanent water sources, new water plants, softening plants, water mains, wells, well pumping plants, and water supply intakes. Most of the projects are for the enlarging, strengthening, or improving the present distribution system.

Pennsylvania Issues More Orders to Industry

The State of Pennsylvania, through its Sanitary Water Board, has recently issued notices to 19 industries and seven municipalities to prepare plans for waste treatment.

With these latest notices, the total number of notices issued by the Sanitary Water Board has reached 413 to industry and 528 to municipalities.

NOMOGRAPH FOR DETERMINATION OF SLUDGE FILTRATION DATA

By CHARLES M. GARD
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HDQTRS. 2ND SERVICE COMMAND*
NEW YORK, N. Y.

THE plant for which this nomograph was originally prepared is a small plant having an average daily flow of about 0.3 mgd. It provides complete treatment with standard trickling filters and separate heated sludge digesters. At this plant a 6 ft. x 3 ft. dia. vacuum filter was provided. Auxiliary facilities for sludge conditioning prior to filtration provided means for the addition of lime and a ferric iron salt. A 40° Bé. liquid ferric chloride was used which was procured in 12 gal. glass carboys. This stock was usually diluted 1:1 with water and fed with a Proportioneers' Chemical Feeder from a rubber-lined steel tank of approximately 30 gal. capacity. The lime was fed with a Syntron Feeder, dry feed type.

Information Desired

Part of the usual information desired in the filtration of sewage sludge is:

(1) Quantity of anhydrous chemicals used in lbs., and in lbs. per 100 lbs. of dry sludge solids, and

(2) Dry solids of filtered sludge in lbs. (total), and in lbs. per unit of filter area per hr.

Obtaining these four values would appear to be relatively easy. However, the procedure required is actually more involved than one might think.

With the facilities and equipment available at this particular plant the procedure that had to be followed was to determine the dry lime feed in grams per min. and the ferric chloride in ml. per min. of whatever dilution of the 40° Bé. stock solution that was being used. These values were obtained by making determinations at several times during the filter run and averaging the results.

To illustrate the amount of calculation involved without the use of the nomograph, the following example is given:

Assume that

(1) Dry lime feed is 200 grams/min.

(2) $FeCl_3$ feed is 250 ml./min. of a solution of 42° Bé. stock diluted in 1:1 with water.

(3) Time of filter run is 6 hrs.

(4) 3000 gals. of 5 per cent solids sludge are filtered.

(5) Filter area is 55 sq. ft.

Lbs. of dry solids filtered = $(3000)\ (8.33)\ (.05) = \underline{1250}$

Lbs. dry solids per 100 sq. ft. per hr. = $\left(\frac{1250}{55x6}\right)\ (100) = \underline{378}$

Lbs. of lime fed = $\left(\frac{200}{453.4}\right)\ (6)\ (60) = \underline{159}$

Lbs. lime per 100 lbs. dry solids = $\left(\frac{159}{1250}\right)\ (100) = \underline{12.8}$

Lbs. dry $FeCl_3$ = $\left(\frac{250}{1000x3.78}\right)\ (2.31^*)\ (6)\ (60) = \underline{55}$

Lbs. of dry $FeCl_3$ per 100 lbs. dry solids = $\left(\frac{55}{1250}\right)\ (100) = \underline{4.4}$

(*Note—1 gal. of diluted stock as used contains 2.31 lbs. dry $FeCl_3$).

It is realized that the determinations of the quantity of chemicals used during the filter run can be simplified somewhat by different means of measurement. However, the mathematical steps involved in obtaining the final results will remain substantially the same regardless of variations in the measuring technique.

Use of the Nomograph

The same basic data in the example given above will be used to illustrate the use of the nomograph. The same example is indicated on the nomograph also. Using a straightedge, the following sequence of steps are performed:

1—Connect 200 (lime) on scale "1" with 6 on scale "t" and read 159 lbs. of dry lime on scale "C."

2—Connect 250 ($FeCl_3$) on scale "f" with 1:1 dilution ratio on scale "B" and locate point of intersection on pivot line.

3—Connect pivot line point located in step 2 with 6 on scale "t" and read 55 lbs. dry $FeCl_3$ on scale "C."

4—Connect 5 (of solids) on scale "p" with 3000 on scale "S" and read 1250 lbs. dry solids filtered on scale "D."

5—Connect point on scale "D" located in step 4 with point located on scale "C" in step 1 and read 12.8 lbs. dry lime per 100 lbs. dry solids on scale "P."

6—Connect point located on scale "D" in step 4 with point located on scale "C" in step 3 and read 4.4 lbs. dry $FeCl_3$ per 100 lbs. of dry solids on scale "P."

Then by simple calculation

$\left(\frac{1250}{55x6}\right)\ (100) = 378$ lbs. dry solids filtered per 100 sq. ft. per hr.

Limitations

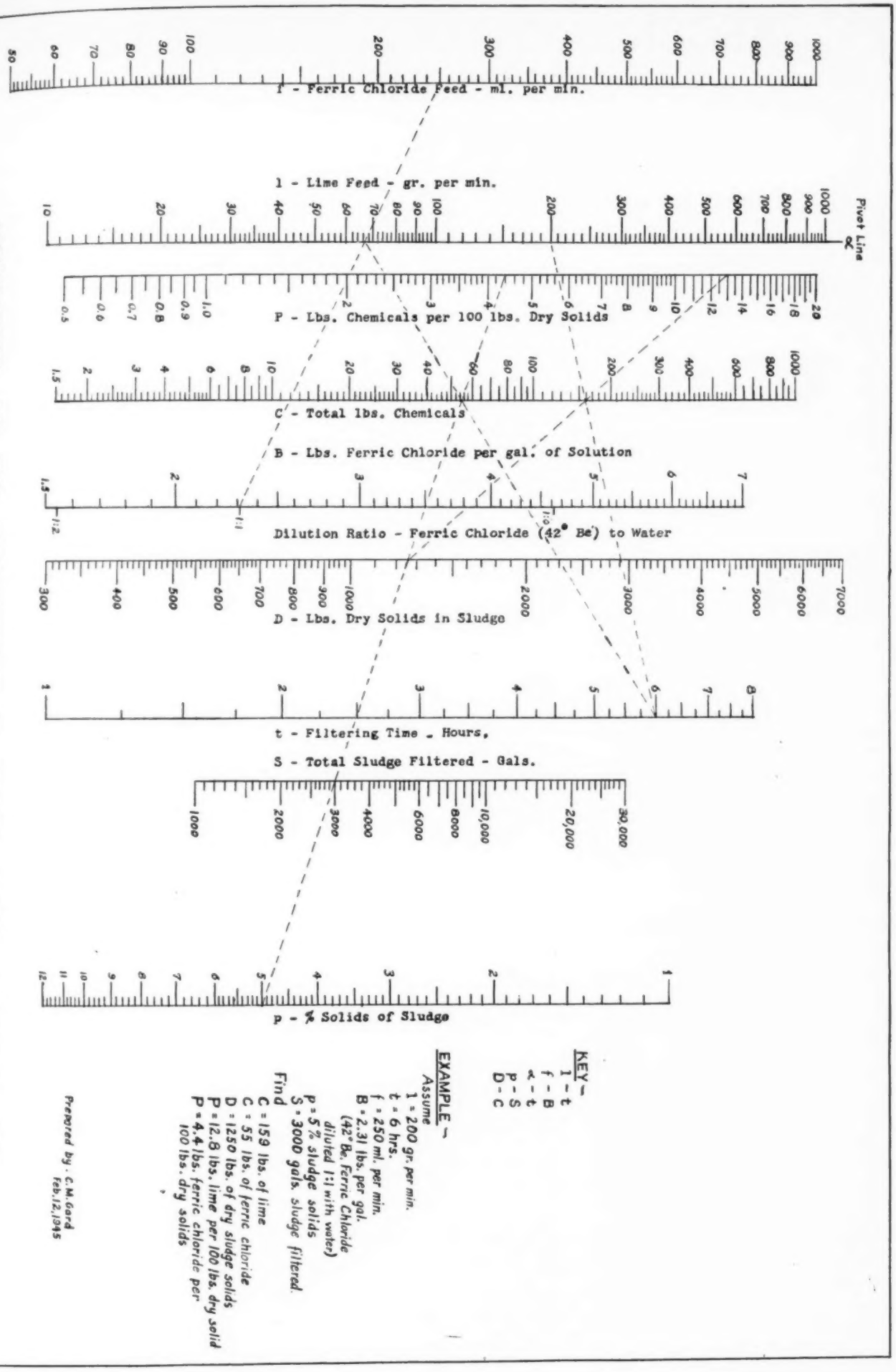
The nomograph has certain limitations. Since it was prepared primarily for use at a small plant, the range of the scale values may be exceeded at larger plants where larger quantities of sludge are handled. This can be overcome by using fractional parts of the actual total values for scales "f," "l," "t," and/or "S" and making appropriate correction in the final answers obtained from the nomograph. For example, by using fractional values of ¼, ⅓ or ½ would give correction factors of 4, 3, and 2, respectively.

The scale for the dilution factor of the ferric chloride is designed for 42° Bé. stock. However, if other concentrations of ferric chloride stock are used, the lbs. of dry $FeCl_3$ per gal. of solution for any dilution used can be predetermined and this value used on the "B" scale, disregarding the recorded dilution ratios on the nomograph.

Summary

Where vacuum sludge filtration is used, this nomograph should facilitate computation of certain desired data as described herein. The author's experience has been that the steps involved in using the nomograph are readily learned by a plant operator and can with a little practice be used by him with assurance of accuracy. The same operator might, however, experience some difficulty in following through the regular mathematical computations involved, and at least would spend more time doing them. The use of the nomograph is particularly time-saving where several calculations have to be made.

*Service Command Engr's Office.


f - Ferric Chloride Feed - ml. per min.
l - Lime Feed - gr. per min.
Pivot Line
P - Lbs. Chemicals per 100 lbs. Dry Solids
C - Total lbs. Chemicals
B - Lbs. Ferric Chloride per gal. of Solution
Dilution Ratio - Ferric Chloride (42° Be) to Water
D - Lbs. Dry Solids in Sludge
t - Filtering Time - Hours,
S - Total Sludge Filtered - Gals.
p - % Solids of Sludge
KEY -
l - t
f - B
t - t
P - S
D - C
EXAMPLE -
Assume
l = 200 gr. per min.
t = 6 hrs.
f = 250 ml. per min.
B = 2.31 lbs. per gal. (42° Be. Ferric Chloride diluted 1:1 with water)
p = 5% sludge solids
S = 3000 gals. sludge filtered.
Find
C = 159 lbs. of lime
C = 55 lbs. of ferric chloride
D = 1250 lbs. of dry sludge solids
P = 12.8 lbs. lime per 100 lbs. dry solid
P = 4.4 lbs. ferric chloride per 100 lbs. dry solids
Prepared by: C.M. Gard
Feb. 12, 1945

NOMOGRAPH FOR THE DETERMINATION OF SEWAGE SLUDGE FILTRATION DATA

RECENT WATER AND SEWAGE WORKS PROJECTS

Federal Loans Made Since July 1 for Construction Plans

IN AUGUST 1945 *Water & Sewage Works* (then *Water Works & Sewerage*) began listing water and sewage works projects for which the Federal government had made loans for plan preparations.

Herewith the sixth such listing, this one covering the period of July 1 to Oct. 15 of this year, shows 339 projects in 304 communities in 42 states.

A summary of the listings published is shown in the following tabulation:

Issue of W. & S. W.	No. of Projects	No. of Communities
Aug., '45	77	61
Sept., '45	122	100
Nov., '45	206	165
Apr., '46	629	526
Aug., '46	423	346
Nov., '46	339	304
Total to date	1,796	1,502

The funds for these plans are made available through the Bureau of Community Facilities of the Federal Works Agency and are to be repaid when construction is begun.

The following list shows the communities receiving the most recent loans and the estimated cost of the completed projects.

Community and Facility	Estimated Cost
Alabama	
Atmore (water)	74,600
Beatrice (water)	44,714
East Brewton (sewage)	108,000
East Brewton (water)	45,000
Foley (sewage)	33,820
Mobile (sewage)	874,374
Opelika (sewage)	579,692
Scottsboro (sewage)	61,000
Arizona	
Coolidge (sewage)	293,500
Nogales (water)	269,100
Phoenix (sewage)	730,000
Tempe (water)	114,700
Tolleson (sewage)	170,750
Town of Holbrook (water)	73,800
Yuma (sewage)	250,000
California	
Alhambra (sewage)	523,216
Alhambra (sewage)	704,800
Burbank (water)	181,954
Costa Mesa (sewage)	438,000
Dunsmuir (sewage)	66,000
Fillmore (sewage)	257,000
Indio (sewage)	177,723
Larkspur (sewage)	110,750
Mariposa Co. (water & sewage)	200,960
San Jacinto (sewage)	126,279
Santa Barbara (sewage)	777,287
Santa Maria (water)	81,000
Santa Rosa (water)	114,000
Strathmore (sewage)	116,510
Trinity Co. (sewage)	60,000
Vista (sewage)	70,920
Colorado	
Gunnison (sewage)	150,000
Holyoke (sewage)	51,000
Lafayette (water)	111,000
Nederland (water)	47,400
Connecticut	
Bristol (sewage)	630,880
Florida	
Belle Glade (sewage)	422,400
Cocoa (sewage)	191,000
Coral Gables (sewage)	358,165
Delray Beach (sewage)	760,000
Dunedin (sewage)	223,500
Fort Pierce (sewage)	151,320
Fort Pierce (sewage)	240,900
Gulfport (sewage)	375,000
Jacksonville (sewage)	549,500
Jacksonville Beach (sewage)	605,000
Lake Wales (sewage)	284,000
Live Oak (sewage)	181,210
Milton (sewage)	141,000
Orlando (sewage)	209,300
Ormond (water)	300,000
Pahokee (sewage)	209,725
Sanford (sewage)	381,000
Tampa (sewage)	1,092,346
Tarpon Springs (water)	70,400
Winter Park (sewage)	645,000
Georgia	
Adel (sewage)	100,000
Alma (sewage)	140,000
Appharetta (sewage)	66,000
Bainbridge (sewage)	212,000
Bainbridge (water)	38,000
Baldwin (sewage)	78,478
Baldwin (water)	16,706
Baxley (sewage)	40,000
Blairsville (sewage)	55,779
Blairsville (water)	52,997
Cairo (water)	371,780
Cochran (sewage)	195,000
Dawson (sewage)	258,000
Dublin (water)	32,960
Fitzgerald (sewage)	221,766
Hogansville (sewage)	39,217
Jasper (sewage)	62,401
Jasper (water)	16,610
Metter (sewage)	122,000
Molena (water)	46,933
Moultrie (water)	156,210
Royston (water)	69,030
Smyrna (sewage)	129,120
Tallapoosa (sewage)	89,000
Tn. of Roswell (sewage)	189,500
Idaho	
Dietrich (water)	32,100
Montpelier (sewage)	64,300
Montpelier (water)	27,250
Illinois	
Alorton (sewage)	311,000
Brookfield (water)	241,453
Centralia (water)	150,000
Chatsworth (sewage)	128,000
Elmwood Park (sewage)	769,841
Herrick (water)	67,400
Lacon (water)	44,000
La Harpe (sewage)	110,500
Minonk (sewage)	141,600
Plainfield (sewage)	110,000
San Jose (sewage)	81,000
Savanna (water)	235,495
Schram City (sewage)	97,043
St. David (water)	89,000
St. Jacob (water & sewage)	109,979
Summit (sewage)	346,675
Thompsonville (water)	177,188
Wamac (sewage)	105,000
Washington (sewage)	147,000
Waukegan (sewage)	483,000
Indiana	
Fort Wayne (sewage)	836,000
Huntingburg (sewage)	169,000
Indianapolis (sewage)	880,000
La Crosse (water)	100,000
South Bend (sewage)	3,109,000
Westport (water)	74,000
Iowa	
Polk City (water)	41,976
Salem (sewage)	55,982
Sibley (sewage)	66,462
Spencer (sewage)	238,572
St. Charles (water)	40,000
Tama County (sewage)	38,973
Tn. of Clearfield (sewage)	78,309
Tn. of Clearfield (water)	49,387
Tn of Minburn (water)	41,350
Tn. of Radcliffe (sewage)	68,216
Van Meter (water)	32,300
Kansas	
Kincaid (water)	27,500
Lakin (sewage)	17,600
Lakin (water)	52,550
St. Francis (sewage)	361,411
Kentucky	
Auburndale-Fairdale (water)	187,250
Burkesville (sewage)	84,699
Cave City (water)	85,532
Jamestown (sewage)	81,928
Lone Oak (water)	155,000
New Haven (sewage)	70,615
Sebree (sewage)	83,252
Tomkinsville (sewage)	154,530
Waverly (water)	43,948
West Liberty (sewage)	112,822
Winchester (sewage)	76,590
Louisiana	
Cotton Valley (sewage)	83,000
Lafayette (sewage)	152,000
Lake Charles (sewage)	750,000
Mansfield (sewage)	184,369
Maryland	
Federalsburg (sewage)	190,000
Massachusetts	
Gardner (sewage)	275,000
Ipswich (sewage)	600,000
Michigan	
Battle Creek Twshp. (sewage)	391,458
Benton Harbor (water)	770,000
Casnovia (sewage)	40,000
Croswell (sewage)	110,000
Empire (water)	27,000
Hamtramck (sewage)	611,465
Lansing Twshp. (sewage)	390,000
Lansing Twshp. (sewage)	410,000
Lansing Twnshp. (water)	826,000
Sault Ste. Marie (sewage)	390,312
Wayne (sewage)	261,759
Minnesota	
Ada (sewage)	96,712
Fisher (water)	35,000
Moorhead (sewage)	236,417
Winthrop (sewage)	113,000
Mississippi	
Rolling Fork (sewage)	90,000
Starkville (sewage)	221,475
Waynesboro (sewage)	15,097
Wiggins (sewage)	108,682
Missouri	
Berkeley (sewage)	230,000
Blackwater (sewage)	35,661
Blackwater (water)	40,564
Cardwell (water)	74,000
Caruthersville (water & sewage)	290,017
Grant City (sewage)	69,136
Grant City (water)	83,535
Kansas City (sewage)	873,000
Lilbourn (sewage)	94,000
Madison (water)	60,000
Malden (sewage)	162,000
Malden (water & sewage)	151,500
Moberly (water)	185,000
New Florence (water)	73,339
Normandy (sewage)	208,894
O Fallon (sewage)	56,295
Owensville (sewage)	104,278
Palmyra (water)	85,600
Portageville (sewage)	73,314
Potosi (water & sewage)	116,900
Rolla (sewage)	134,988
St. Louis County (water)	132,000
Sullivan (water)	188,414
Sweet Springs (sewage)	112,500
Warrensburg (sewage)	300,000
Nebraska	
Brule (water)	43,306
Cozad (sewage)	74,065
Dawson (sewage)	52,263
Dakota City (sewage)	60,500
Gordon (sewage)	32,815
Gordon (water)	31,778
Oakland (water)	88,732
Oakland (sewage)	48,486
Stromsburg (sewage)	87,710
Tecumseh (water)	77,837
Nevada	
Las Vegas (sewage)	966,500
Lovelock (sewage)	35,410
Lovelock (water)	75,400
Washoe County (sewage)	1,022,300
New Hampshire	
North Hampton (water)	191,200
New Jersey	
Bergen-Hackensack San. Dist. (sewage)	5,207,000
Piscataway Twnshp. (sewage)	316,700
Sayreville (sewage)	122,450
Wallington (sewage)	212,750
New Mexico	
Espanola (sewage)	102,148
Tularosa (sewage)	78,200
New York	
Onondaga County (sewage)	1,153,000
Rotterdam (water)	104,000
Schenectady (sewage)	450,000
North Carolina	
Andrews (water)	134,063
Fayetteville (water)	80,000
North Dakota	
Bisbee (water)	56,500
Bismarck (sewage)	816,000
Bismarck (water)	535,000

Community and Facility	Estimated Cost
Ohio	
Bottineau (sewage)	70,000
Dickinson (sewage)	39,600
Dickinson (water)	48,640
Dickinson (water)	67,275
Dickinson (water)	273,465
Fordville (water)	61,700
Grenora (water)	31,000
McClusky (sewage & water)	27,800
Velva (sewage)	67,900
Ohio	
Aberdeen (water)	39,582
Akron (sewage)	300,000
Akron (water)	412,000
Antwerp (sewage)	177,000
Barberton (water)	123,454
Centerville (sewage)	130,000
Continental (sewage)	150,000
Edgerton (sewage)	95,000
Fayetteville (water)	37,000
Greenfield (sewage)	258,051
Hubbard (sewage)	45,000
Kenton (sewage)	265,000
Kenton (water)	67,000
La Rue (water)	123,900
Toledo (sewage)	997,465
Washington Court House (sew.)	165,000
Winchester (water)	121,630
Oklahoma	
Ada (water)	150,000
Ada (water)	1,035,000
Bethany (sewage)	99,966
Broken Bow (sewage)	86,120
Checotah (sewage)	36,168
Chelsea (water)	170,000
Muskogee (sewage)	200,000
Muskogee (water)	1,030,000
Poteau (sewage)	152,812
Poteau (water)	59,738
Vian (water)	39,500
Wakita (sewage)	42,250
Oregon	
Rainier (water)	75,500
Sandy (sewage)	66,100
Phoenix (sewage)	99,500
Pennsylvania	
Bellwood (sewage)	59,500
Hyndman (sewage)	115,300
Logan Twnshp. (sewage)	259,300
Monaca (sewage)	251,800
Nanticoke (sewage)	708,438
Phoenixville (sewage)	229,310
Phoenixville (water)	61,500
Pottstown (sewage)	357,700
South Carolina	
Andrews (water)	46,850
Bennettsville (sewage)	59,000
Brunson (water)	56,000
Clinton (sewage)	113,350
Conway (sewage)	180,790
Kingstree (sewage)	47,390
Kingstree (water)	21,700
Lake City (sewage)	85,000
Lake City (sewage)	31,000
Lancaster (water & sewage)	978,400
Lando (sewage)	69,000
Laurens (sewage)	148,035
Laurens (water)	423,800
Newberry (sewage)	137,000
Orangeburg (sewage)	157,500
Orangeburg (sewage)	129,082
Orangeburg (water)	151,000
Summerton (sewage)	28,550
Tn. of Wagener (sewage)	65,000
South Dakota	
Colman (sewage)	61,000
Tennessee	
Bluff City (water)	177,471
Bruceton (sewage)	70,565
Bruceton (water)	71,016
Cookeville (water)	365,750
Hawkins Co. (water)	210,516
Humboldt (sewage)	221,710
Lawrenceburg (water)	103,850
Mount Pleasant (sewage)	170,000
Paris (sewage)	600,000
Portland (water)	51,030
Pulaski (sewage)	80,000
Tn. of Alamo (sewage)	121,095
Trenton (sewage)	148,029
Woodbury (sewage)	28,600
Woodbury (water)	65,637
Texas	
Blossom Prairie (sewage)	38,872
Bonham (sewage)	93,000
Bonham (water)	75,000
Cleburne (sewage)	53,000
Detroit (water)	78,036
Griffing Park (sewage)	150,000
Harris County (sewage)	66,000
Jefferson County (water)	296,000
Jourdantown (sewage)	96,839
Mineola (sewage)	101,312
Peniel (sewage)	39,748
Peniel (water)	38,557
Tarrant County (sewage)	110,000
Temple (sewage)	85,615
Thorndale (sewage)	49,400
Trenton (sewage)	45,000
Waxahachie (sewage)	228,600
Utah	
American Fork (sewage)	313,000
Castle Dale (water)	71,400
Midvale City (sewage)	106,500
Moab (water)	42,700
Monticello (sewage)	66,300
Morgan City (sewage)	123,400
Richfield (water)	59,786
Riverdale (water)	180,000
Salt Lake County (water)	835,929
Sigurd Town (water)	5,545
Virginia	
Fairfax County (sewage)	780,000
Ivor (water)	39,500
Portsmouth (sewage)	171,974
Washington	
Sumner (sewage)	150,000
Sunnyside (sewage)	159,924
West Virginia	
Newburg (water)	73,134
Wisconsin	
Arlington (water)	28,297
La Valle (sewage)	74,961
Superior (sewage)	513,000
Wyocena (sewage)	54,805
Wyoming	
Riverton (sewage)	115,000

Illinois Water Operators Elect Officers

At the 12th annual conference of the Illinois Filter Plant Operators Association, Lewis S. Doren, Supt. of Water at Pekin, was elected chairman for the ensuing year. Retiring Chairman is E. M. Craig of the Zion water department. Herman Garner of Benton was elected as Vice Chairman, and Carl Duy, Aurora, as Secretary.

At the annual dinner, Gerald L. Davis, chief water plant operator at Decatur, was awarded the operator's trophy for the operator who best satisfied the state's requirements.

Principal speaker at the dinner was W. Wilbur Shaw, Pres. of the Indianapolis Motor Speedway, who recounted his famous story of his "busy day" on the track in 1931. Mr. Shaw predicted the use of non-inflammable fuels in future automobiles, and the development of ultra high compression motors, which will be smaller in size and lighter in weight through use of magnesium and aluminum alloys.

Could It Be?

The witness was a fattish little man with the tell-tale purplish red nose.

The cross-questioning attorney: "So you say that you are the superintendent of the water works, eh?"

"Yes, sir. I have occupied this high office and trusted position in this community for ten years without any question as to my trustworthiness."

Shot back the D. A.: "No doubt, you look like a man who could be trusted with any amount of water—but d—— little of the kind known as 'fire.'"

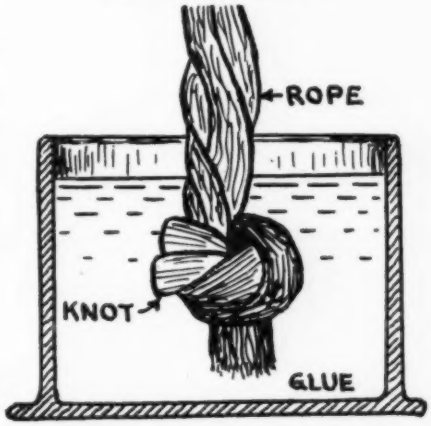
(With apologies to the *Official Bulletin* of the North Dakota Water and Sewage Conference for the above variation of its squib captioned "Trustworthy.")

Penna. Mine Sealing Program Gets Under Way

According to an announcement from Dr. Harry W. Weest, State Health Secretary and Chairman of the Sanitary Water Board of Pennsylvania, the State has resumed its mine sealing program. The first project got underway in September in Clarion County at the headwaters of the Clarion River and Tionesta Creek. The second project was started two weeks later in Clearfield County near the headwaters of Little Clearfield Creek, a tributary of the West Branch of the Susquehanna River.

Some of these first projects are to replace old seals built under W. P. A. some years ago. Several of these old seals have failed. The sealing operations under way are designed to reduce the production of acid mine waters which more than neutralize the natural alkalinity of the rivers and cause added trouble and expense to water utilities using such streams, kill fish, and do other damage.

A Knotty Kink*



To prevent a knot from untying, dip it in glue as shown in this sketch. It has been this writer's experience that when knotting the end of a rope to prevent fraying, the knot frequently "slips out" due to the slipperiness and stiffness of the rope, especially if it is a new one. Make the knot as hard and tight as possible, dip in glue, allow to dry, and, like Alexander the Great, you will be obliged to cut it if you want to untie the knot. If you have no glue, black japan, liquid shellac and similar moisture and heat resistant paints will serve the purpose very well in place of glue.

*Contributed by W. F. Schaphorst, M.E., Newark, N. J.

WATER AND SEWAGE PATENTS

(Of Recent Issue)

WATER PATENTS

Well Pump. Wilson T. Smith, Los Angeles; U. S. 2,404,930; July 30, 1946 (Appl. 8-21-45).

Portable Water Purification and Filtration Unit. Jerome B. Levy (to Titeflex, Inc., Newark, N. J.); U. S. 2,404,967; July 30, 1946 (Appl. 4-14-43). A water treatment apparatus comprising in combination a tank containing water and adapted to receive and retain air under pressure, and a filter unit having a porous filter stone therein, with pressure vessels in between, actuated by plungers which force water through filter stone.

Process for the Treatment of Water by Suppressing Ions of Alkaline Earth Metals. Ambrose George Taylor (to Calgon, Inc., Pittsburgh, Pa.); U. S. 2,405,276; Aug. 6, 1946 (Appl. 4-16-41). Process for softening water by adding potassium Kurrol salt together with an ammonium salt, or by adding potassium Kurrol salt with Maddrell salt. These salts apparently are combinations of potassium metaphosphates with nitrates, carbonates, etc.

Water Treatment Device. Fred W. Whitlock (to Automatic Pump & Softener Corp.); U. S. 2,405,479; Aug. 6, 1946 (Appl. 5-31-41). A water softener of the ion-exchange type, with necessary means for regeneration.

Filtering Apparatus. William Smalley (to The Paterson Engineering Co., Ltd., London, Eng.). Reissue U. S. 22,784; Aug. 27, 1946 (Original No. 2,384,972). A sand filter with wash water trough and closeable aperture in trough wall just above sand level.

Fluid Quantity Measuring Device. Hans von Hortenau (to Stig K. M. Billman, Stockholm, Sweden); U. S. 2,406,723; Aug. 27, 1946 (Appl. 9-6-44). Metering device to be inserted in a fluid conduit, consisting of a rotating shaft connected to a turbine which is, in turn, connected to an electric generator.

Multistage Centrifugal Pump. Erik G. Landberg (to Gould Pumps, Inc., Seneca Falls, N. Y.); U. S. 2,407,987; Sept. 24, 1946 (Appl. 4-3-42).

SEWAGE PATENTS

Pipe Forming Machine. Herman L. Moor, Olive Tnshp., St. Joseph Co., Ind.; U. S. 2,406,025; Aug. 20, 1946 (Appl. 5-31-43). A machine for forming a pipe in a trench by feeding plastic material (concrete) into machine which projects it rearward and forms pipe within form which moves forward.

These patent abstracts being brief do not necessarily cover the entire scope of the invention described. If the reader becomes especially interested in any of these patents he should obtain printed copies of the complete patent, at 25 cents each, from the Commissioner of Patents, Washington 25, D. C.

Liquid Solids Separation Apparatus. Edwin A. Packard, Yonkers, N. Y.; U. S. 2,406,248; Aug. 20, 1946 (Appl. 12-3-43). A device consisting of a tank totally enclosed with means for continuous addition and removal of liquid containing solids, and subjecting that liquid to a subatmospheric pressure, thereby causing the release of dissolved gases and the flotation of some of the solids which are removed from the tank as a scum.

Septic Tank Clear Water Discharge. Robert Lee Zabel, Louisville, Ky.; U. S. 2,406,523; Aug. 27, 1946 (Appl. 11-8-44). A method of providing drainage arrangement for the effluent from a septic tank to bed rock areas below.

Process of Utilizing Waste Liquors. Hilding Olof Vidar, Bergstrom, Stocksund, and Karl Gustaf Trobeck, Stockholm, Sweden; U. S. 2,406,581; Aug. 27, 1946 (Appl. 5-22-43). A process of utilizing waste sulfate liquor which comprises concentrating the liquor while contacting it with air in quantity sufficient to substantially eliminate evolution of hydrogen sulfide during subsequent evaporation to dryness.

Method of Purifying Oil Field Waters. Harold Schiller and Abraham Shapiro (to Socony-Vacuum Oil Co., Inc., New York, N. Y.); U. S. 2,407,180; Sept. 3, 1946 (Appl. 10-30-43). A method for removing clay-suspended petroleum from oil-field water, by passing through a bed of granular ferrous sulfide.

Apparatus for the Clarification of Liquids. Alfred Butcher (to Gulf Oil Corp., Pittsburgh, Pa.); U. S. 2,407,947; Sept. 17, 1946 (Appl. 6-19-45). A clarifier tank in which the liquid is introduced downward into the tank through a gradually enlarging downcomer pipe. Liquid upflow is broken and returned downward by annular baffle, from whence the flow is upward through outside annular space and over a weir, at peripheral wall. Rotating sludge collector and withdrawal of sludge from bottom also part of device.

Cyclone Dust Collector. Joe Crites (to Combustion Engineering Co., Inc., New York, N. Y.); U. S. 2,408,250; Sept. 24, 1946 (Appl. 1-26-44). A cyclone separator.

Backwater Valve. Samuel Olson, Chicago, Ill.; U. S. 2,409,582; Oct. 15, 1946 (Appl. 10-26-44). A sewer drain outlet with closeable valve to prevent backwater flow.

Supernatant Selector Device for Sludge Digestion Tanks. William M. Piatt, Durham, N. C. (to Pacific Flush Tank Co., Chicago, Ill.); U. S. 2,409,585; Oct. 15, 1946 (Appl. 4-16-42). A device constructed within a sludge digestion tank for the purpose of automatically discharging the supernatant liquor for the point in the tank where the concentration of sludge solids is lowest. The device consists of a slotted tube disposed vertically within the central zone of a tank and connected to a withdrawal line.

THE SCUM PROBLEM FROM THE OPERATORS' STANDPOINT*

By JOSEPH DOMAN
Sanitary Engr.
DEPT. OF PUBLIC WORKS
GREENWICH, CONN.

PART of the job of operators of separate sludge digestion systems is to secure proper digestion of solids in units already designed and constructed. No matter how similar the digestion units, each plant has its own individual patterns of behavior which must become known if satisfactory operation is to be secured. With reference to the scum problem, however, whatever differences there may be in behavior between individual plants, they are only differences in details as the scum problem is essentially of the same general pattern for all separate sludge digestion plants. It is the purpose of this brief discussion to present this general pattern along with some important details pertaining to plant operation.

The Author

Essentials of the Scum Problem

As seen by the operator, the scum problem is essentially this: How can favorable digesting conditions be maintained in the scum layer in his own particular digestors? Regardless of the number, type and per capita capacity of digestors, the operator must aim at four objectives in order to solve this problem: (1) He must keep the scum layer properly thin and wet; (2) he must keep the scum solids well impregnated with digesting organisms; (3) he must maintain satisfactory digesting temperatures in the scum layer as well as in the rest of the digestor; and (4) he must maintain proper alkalinity in the scum as well as in the rest of the digestor. With digestors of insufficient capacity it will be much more difficult to achieve these objectives than with digestors of ample size, but if these objectives are aimed at, the operator can often improve the functioning of even overloaded digestors.

*Presented at the 6th Conn. Conference of Sewage Works Superintendents & Operators, Hartford.

Keeping the Scum Layer Properly Thin and Wet

Unless the scum layer is kept sufficiently thin and wet, it will become so thick and compact as to prevent proper impregnation with digesting organisms; it will not be maintained at proper temperature; and it will probably develop an acid reaction, all of which are highly unfavorable for proper digestion. The importance of keeping the scum thin and wet is, therefore, very apparent.

Many digestors are equipped with either rectangular or circular mechanisms which slowly scrape or plow the scum from one part of the tank to another and then down into the supernatant below. The mechanisms are supposed to be operated a sufficient length of time every day to keep the scum well broken up and thus keep the scum thickness down to but a few inches.

Some digestors are now equipped with horizontal propellers on a motor-driven vertical shaft to keep the entire digestor contents either continually or periodically agitated.

Digestors with scraping or propelling mechanism are usually of the fixed roof type in which some of the digestor contents flow out of the tank

Old Greenwich Sewage Treatment Plant—Town of Greenwich, Conn.
View from the main line of the New Haven R.R.—sludge digester in foreground—Recirculation of supernatant liquor practiced here and at Grass Island Treatment Plant in Greenwich.

when the raw sludge is being pumped in. The pumping of raw sludge provides more or less agitation in the digestor; hence the digestor effluent often contains an undesirably high amount of sludge solids. For this reason tanks equipped with such mechanism find their best application as primary digestors in two-stage digestion systems in which a secondary digestor, often of the floating cover type and without inside mechanism, is provided to render a better clarified supernatant as drawn from the tank and to further the completion of the digestion process. Excellent scum control is sometimes achieved by digestors equipped with mechanical scrapers or propellers, but sometimes the character of the sludge and method of operation are such that results are quite disappointing.

Some digestors are equipped with stationary perforated pipes or revolving jets directly in the scum layer, supernatant being pumped through them at times to keep the scum wet and agitated. Stationary perforated pipes have usually been unsatisfactory and the scum may become sufficiently compacted to render revolving jets also ineffective.

In digestors of the submerged roof, floating cover type, the most effective means of keeping the scum thin and wet is to pump relatively large quantities of supernatant liquor at low discharge pressure onto the top of the scum, the discharge point usually being several feet above the scum in the central collecting dome. Sometimes it is also advantageous to pump the supernatant into inspection manholes between the center dome and outside edge of the cover. Low pressure discharge is preferred to high pressure jetting because thoroughly wetting the scum has been found more effective than jetting, which develops short-circuiting channels through the scum into the supernatant.

The low pressure discharge also releases gas from the pumped supernatant so that with prolonged pumping the entire digestor contents become sufficiently degassed below the saturation point to reabsorb gas from the underside of the scum layer and permit the degassed solids to settle out. A proper flushing program of this sort will usually keep the scum sufficiently thin and wet to allow the establishment of favorable conditions for digestion. In developing such a program it is advisable to time the flushing after overnight settling or at least two hours after pumping raw sludge into the digestor in order to avoid introducing an excessive amount of raw solids into the scum along with the pumped supernatant.

In some cases the addition of ammonium sulphate has been reported as effective in dispersing and digesting scum while in other cases results have been reported as disappointing. This process is covered by patents and should not be employed without proper permission. Competent technical supervision is also required.

While many operators have succeeded in keeping the scum properly thin and wet, the foregoing considerations make it quite clear that considerable difficulty is encountered at many plants and each operator has to work out the best method for his own particular plant. It must also be borne in mind that some of the floating materials are of such character that they will not digest at all in spite of satisfactory temperatures, seeding and alkalinity. If allowed to accumulate, these materials may build up a troublesome layer of either oily or compacting material, thereby causing considerable impairment of digestor efficiency. These undigestible materials must be physically removed from the digestor either by pumping, scraping to a collecting well, scooping, or otherwise.

Keeping Scum Solids Impregnated With Digesting Organisms

When any of the above methods are effectve in keeping the scum thin and wet, the intimate contact provided with the supernatant will usually provide sufficient impregnation with digesting organisms. Sometimes, however, it is advisable to reinforce the supernatant with digesting organisms by recirculating sludge from the bottom of the digestor into the supernatant. This type of sludge recirculation is regarded as preferable for this purpose to discharging sludge onto the scum as in the latter case some of the sludge solids may become entrapped in the scum and build up its thickness.

Maintaining Satisfactory Temperatures in the Scum Layer

Some of the floating solids, such as vegetable oils and greases, will digest only at relatively high temperatures. Although satisfactory digestion may take place at an average temperature of around 85° F., some of the digestible oils and greases require temperatures of at least 95° F. In boilers burning sludge gas there may be times, particularly in the winter, when sufficient sludge gas is not produced to maintain the required temperatures. When sufficient auxiliary fuel may require a considerable expenditure, digestor temperatures are permitted to remain relatively low with consequent impairment of digestion of scum solids. Under these circumstances the best that can be done is to maintain the scum as thin and wet as possible, maintain the digestor at the highest temperature consistent with reasonable expense and also keep it at proper alkalinity as determined by pH or alkalinity tests or both. Considerable work has been done recently to provide more efficient transfer of heat into digestors, including units for preheating of raw sludge, but these newer developments have not as yet found extensive use in digestor construction and remodelling.

Maintaining Proper Alkalinity In the Scum

The pH tests should be made at least twice a week to indicate conditions of alkalinity or acidity in the sludge, supernatant and scum layers. Alkalinity tests are also of value although they are usually omitted at the smaller plants. The digestive organisms usually thrive best when the pH is at or slightly above the neutral point, 7.0, although many digestors will function well at a pH of 6.8 or even 6.7. In the newer concepts of digestor operation, the use of lime is frowned on under any conditions. Where lime has been added at regular intervals to maintain a satisfactory pH, it has generally not been used when the total alkalinity is ample even when the pH drops below 6.7, and if added at all should be discontinued when the pH rises above 7.0. A pH of 8.0 or over is usually indicative of free caustic, which will kill off desired digestive organisms while a pH of 6.5 or less indicates sufficient acidity to inhibit desired organisms.

If lime is used, it may precipitate into the sludge and give it an undesirably high pH, thereby interfering with sludge digestion while the supernatant has a pH of around 7.0. This condition can be remedied by recirculating the bottom sludge into the supernatant. Usually when the scum is kept thin and wet it will have about the same pH as the supernatant, but if it becomes thick and compact and contains an appreciable amount of raw solids, the pH may become lowered to 5.5 or less. From a practical standpoint the most advisable corrective procedure is to maintain the pH of the supernatant somewhat above 7.0 and keep the

scum wet with it rather than try to add lime solution directly to the scum in which it may concentrate in spots without exerting extensive acid neutralizing influence or may even provide caustic destruction of digestive organisms.

Location of Scum and Sludge Layers

Digestor operation can be helped greatly by frequent measurements to determine the location of scum and sludge layers, thus giving the thickness of scum, sludge and supernatant layers. Unfortunately, such measurements with bottle sampling outfits are messy and time consuming, while measurements with plunging rods can easily develop too great an error for reliability.

Some digestors are equipped with a battery of sampling pipes at different levels and if daily samples are taken from these pipes and allowed to settle out for ten minutes the sludge elevation can be estimated approximately between the highest sample showing sludge and the lowest sample showing supernatant, while the scum elevation can be estimated between the highest sample showing supernatant and the lowest sample showing scum. Occasional check measurements with bottle sampling outfits should be made to verify these estimates and provide corrective factors if necessary. If the sampling pipes are not more than two and a half feet apart vertically in the digestor, the error in thus locating the sludge and scum lines will probably be less than a foot and the estimation would therefore be of sufficient accuracy for all practical purposes. When the sampling points are spaced at a greater vertical interval, a greater error will be obtained and a more accurate method must be used than merely observing the samples for interpolating the scum and sludge elevations between the proper sampling points.

When daily records can be obtained of location and thickness of scum, sludge, and supernatant layers they will give a check on the effectiveness of various digestor operations and also act as a guide in indicating when and how much sludge to draw off, what scum operations are required, what level to use in drawing off supernatant and help explain the actual functioning of the digestor. The scum problem is so closely tied in with all other phases of digestor operation that it is really necessary to have a good picture of digestor conditions and functioning in order to solve the scum problem satisfactorily, and this picture can be best obtained by frequent measurements giving the location and thickness of the various layers in the tank.

Summary

Briefly summarizing the foregoing considerations, one finds that the scum problem as seen from the operating standpoint consists of establishing proper digestion conditions for the material which rises to the top of the digestor, more difficulty being encountered with overloaded digestors than with those of ample size. The most important of these conditions is a proper temperature in the scum as well as in the rest of the digestor, a scum temperature of at least 95° F. being preferable if it can be obtained at reasonable cost. The next most important condition is a proper alkalinity, a pH slightly above 7.0 being preferable if obtainable, a pH of 6.8 being acceptable otherwise. With satisfactory conditions of temperature and alkalinity, proper seeding of the scum with digesting organisms will complete the major requirements for scum digestion. The key to the solution of the scum problem lies in keeping the scum thin and wet to allow favorable digesting conditions to become prevalent. Undigestible material must be physically removed from the digestor. The operator can only hope to solve his own particular scum problem by efficient operation of the digestor as a whole, and, to secure and check such operation, frequent determinations of the location and thickness of scum, sludge and supernatant layers are required.

Indianapolis Manager's Secretary Retires After 45 Years

Miss Blanche Tullis Served Under Five Managers

On Oct. 4, Miss Blanche Tullis, secretary to the general manager of the Indianapolis Water Co., retired after 45 years of service in that same capacity under five general managers. Last year Miss Tullis was one of 49 employees who received the John N. Hurty Service Award from the State Board of Health for more than 25 years of service.

Herb Moore Returns to Consulting Practice

Herbert Moore, of Milwaukee, has returned to private practice as a consulting sanitary engineer after three years in the Sanitary Corps of the Army. A graduate of Cornell, with a master's degree from Harvard, "Herb" Moore started work in sanitary engineering with Greeley and Hansen and later worked for the Jerry Donahue Engineering Co. of Sheboygan, Wis. In addition to acting as resident engineer on many water supply and sewage disposal projects, Mr. Moore was the sanitary engineer employed by the Congress Hotel Co., Chicago, to supervise the installation of new plumbing following the amebic dysentery epidemic in 1934-35.

Mr. Moore's new office address will be 259 E. Wells St., Milwaukee.

As True Today as Yesterday!

It is well for a man to respect his own vocation whatever it is, and to think himself bound to uphold it, and to claim for it the respect it deserves.

—Charles Dickens.

S. K. Love Succeeds W. D. Collins in U.S.G.S.

On Oct. 1, S. Kenneth Love succeeded W. D. Collins as Chief of Water Quality Division of the U. S. Geological Survey, Washington, D. C. Mr. Collins retired after 26 years' service in the position.

Mr. Love, a native of Erie, Penna., was graduated from the University of Florida with a B.S. in 1927 and received an M.S. degree in 1930. Except for the period spent in graduate study under Prof. A. P. Black, Mr. Love has been with the U. S. Geol. Survey since 1928, working on both laboratory and field studies.

The Editor's Comments

On Making a Place for the Industrial Waste Man

Late last month a new sewage works association was born in the South. Standing as its godfather was the Kentucky-Tennessee Section of AWWA, with the secretary-treasurer of this Section becoming also the secretary-treasurer of the Kentucky-Tennessee Sewage Works Association.

The functioning of the new association will follow the pattern of the North Carolina Sewage Works Assn., which has long been accepted as a "twin" of the N. C. Section of AWWA. Although the meetings of the sewage works association are held concurrently with those of the water works group, there is a separate maintenance of membership in the AWWA Section and the Sewage Works Association. Except for the office of secretary-treasurer, all other offices are filled by separate nominations and elections. A combination program and a single annual dinner, where introduction of new officers takes place, honors and awards announced, and entertainment is provided, serves both groups advantageously and economically.

It so happens in North Carolina, as is also the general trend elsewhere, that a majority of water works men are also members of the Sewage Works Association, due to the fact that a preponderance of North Carolina municipalities have their water supply and sewage disposal facilities managed and operated as a combination enterprise within one department and under one general head. In such cases the top employees function in both of these twin utilities, frequently referred to in recent times as "Water Supply—New and Used."

More and more each year into the sewage disposal picture is coming that of the disposal of a different kind of sewage—the sewage of industry, more commonly known as industrial wastes. However, like sewage, industrial wastes can properly be considered the "Used Water Supply of Industry." For the past three years one of the important considerations of the Board of Control of the Sewage Works Federation (National) has been that of industrial wastes. Considerable space has been given industrial waste treatment on the Federation's technical programs, and in the Sewage Works Journal. It has also been argued by some of the Board of Control members that a place within the member associations and the Federation proper should be made for those who are principally concerned with the treatment and disposal of industrial wastes. Not only should these representatives of industry be given leading committee positions in the Federation, according to our thinking, there should be created within the Federation an "Industrial Wastes Division."

We continue to advocate this move with a belief that without some such arrangement, designed to provide an opportunity for organization and the exchange of information and ideas on a common meeting ground, a new and separate organization for the rapidly growing industrial waste fraternity would appear to be inescapable. Once this has taken place, it would be more difficult to consolidate the two organizations than to promptly make a place for the industrial sewage interests within the Federation, to the extent of filling an immediate need and also looking toward adding stature to the Sewage Works Federation by broadening its base.

In this direction a highly interesting thing happened at the organization meeting of the new Ky.-Tenn. Sewage Works Assn. In attendance at this meeting were several men concerned with what is ahead for industry in respect to the mitigation of stream pollution by plant wastes. When it came time to choose a Ky.-Tenn. representative to the Federation Board of Control, amongst the several names placed in nomination was that of a top-flight representative of industry who was proposed by a member in charge of water supply and waste disposal for another nationally important industrial plant. It was as much of a surprise as a pleasure to this writer to witness, from the field of several candidates, the election of Mr. James Ellis, General Superintendent, Tenn.-Eastman Corp., Kingsport, Tenn., to the Federation Board of Control.

To our mind this happening is a splendid jesture, representing a highly politic move on the part of the sewage treatment fraternity, which from here on out is to have so much in common with the "stranger within our gates"—the industrialist, with his acute problem of reducing stream pollution through the treatment of industrial sewages. As far as we are aware this Ky.-Tenn. Association action, of recognizing the industrialist as a welcome and desired member of the sewage treatment fraternity, constitutes a worthy precedent and a laudable action. May the Federation Board, as well as the individual member associations of the Federation, take due note of this tactful and broadening move.

Vortices

We have from time to time had this question put to us: "Do the vortex swirls that form near the entrance of intake pipes or drain openings always have one direction of rotation?" In case there are others who have wondered the same thing, we will give the most authentic answer that we have had.

Under normal circumstances if the submergence of the circular outlet drawing from a vessel or reservoir of essentially motionless liquid is less than a critical depth for the particular flow and diameter of outlet, a vortex (or several smaller swirlpools) will form above the outlet. Normally the direction of the swirl will be *counter clockwise* if the location is in the Northern Hemisphere, and *clockwise* if in the Southern Hemisphere.

Now, somebody is obliged to ask the question: "But what happens on the Equator?" The best two answers that we receive to this $64 question will be published in a subsequent issue.

In Panama (not too far from the Equator) this writer has had ample proof that vortices form with vigor and almost without exception in the counter clockwise direction. Now if some fellow comes along with the explanation that on the Equator vortices swirl counter clockwise from 12 M to 12 N and clockwise from 12 N to 12 M (and refuse to form at all on Feb. the 29ths), don't expect to see this in print—"on advice of counsel."

L. H. Enslow

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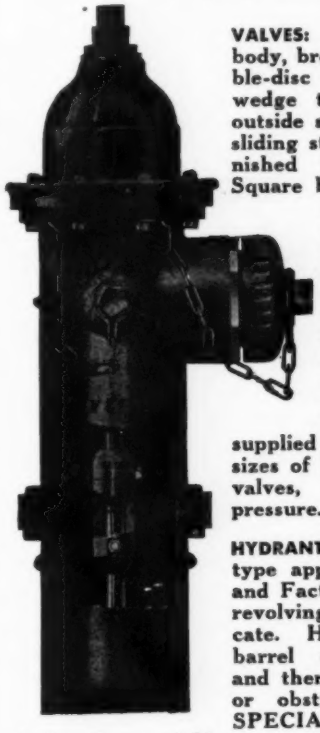

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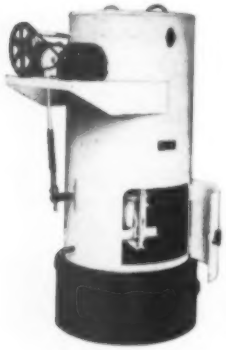

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MEETINGS SCHEDULED

Nov. 14-15—RICHMOND, VA. (Hotel John Marshall)
Virginia Section A.W.W.A. Sec'y-Treas., W. H. Shewbridge, State Dept. of Health, 1506 Greycourt Ave., Richmond, Va.

Nov. 15-17—GREEN BAY, WIS. (Hotel Northland)
Wisconsin Section A.W.W.A. Sec'y-Treas., L. A. Smith, Supt. of Water, City Hall, Madison 5, Wis.

Nov. 18-20—RALEIGH, N. C. (Carolina Hotel)
North Carolina Section A.W.W.A. (Joint Meeting with) **North Carolina Sewage Works Association.** Sec'y-Treas. (both Assns.) Geo. S. Moore, Box 125, Albemarle, N. C.

Nov. 22-24—HAVANA, CUBA (Joint Meeting)
Florida Section A.W.W.A. Sec'y, Dr. A. P. Black, Univ. of Florida, Gainesville, Fla.
Cuban Section A.W.W.A. Sec'y, Laurence H. Daniel, P. O. Box. 531, Havana, Cuba.

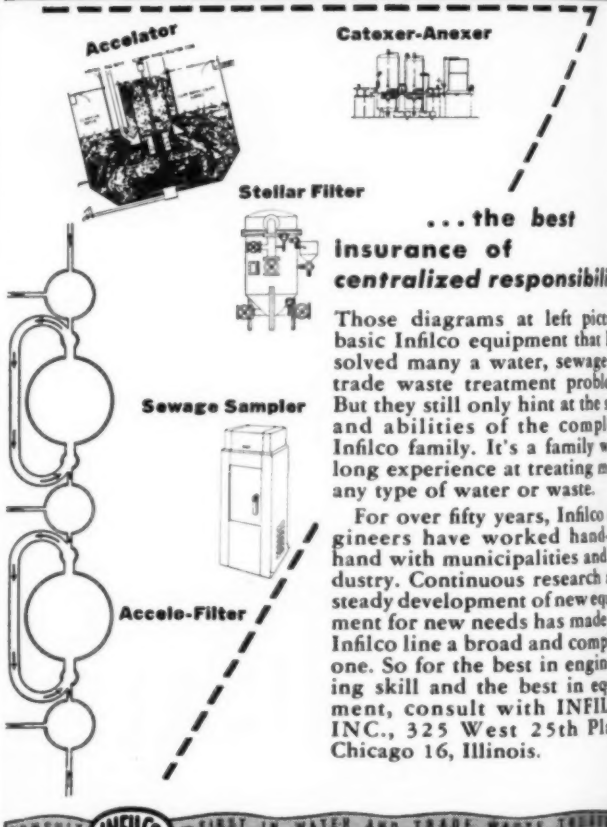
Dec. 2-6—NEW YORK, N. Y. (Hotel Pennsylvania)
American Society of Mechanical Engineers. Exec. Asst. Sec'y, Ernest Hartford, 29 W. 39th St., New York, N. Y.

Dec. 11—AUGUSTA, ME.
Maine Water Utilities Association. Sec'y, Earle A. Tarr, Supt. Water District, Winthrop, Me.

Dec. 19—BOSTON, MASS. (Hotel Statler)
New England Water Works Association. Sec'y-Treas., W. C. Conroy, 609 Statler Bldg., Boston, Mass.

Jan. 13-18, 1947—NEW YORK, N. Y. (Commodore Hotel)
American Society of Civil Engineers. Sec'y-Treas., Wm. N. Carey, 33 West 39th St., New York, N. Y.
(Sanitary Engineering Div. Sessions Jan. 15 (P.M.) Jan. 16 (A.M.)

A complete family



. . . the *best* insurance of *centralized responsibility*

Those diagrams at left picture basic Infilco equipment that has solved many a water, sewage or trade waste treatment problem. But they still only hint at the size and abilities of the complete Infilco family. It's a family with long experience at treating most any type of water or waste.

For over fifty years, Infilco engineers have worked hand-in-hand with municipalities and industry. Continuous research and steady development of new equipment for new needs has made the Infilco line a broad and complete one. So for the best in engineering skill and the best in equipment, consult with INFILCO INC., 325 West 25th Place, Chicago 16, Illinois.

CONSULT INFILCO — FIRST IN WATER AND TRADE WASTE TREATMENT

MEETINGS SCHEDULED

Jan. 17—NEW YORK, N. Y. (Hudson Hotel)
New York State Sewage Works Association. (Annual Meeting.) Sec'y-Treas., A. F. Dappert, State Board of Health, Albany, N. Y.

Jan. 17—NEW YORK, N. Y. (Commodore Hotel)
New York Section A.W.W.A. (Mid-Winter Luncheon Meeting.) Sec'y-Treas., R. K. Blanchard, 50 West 50th St., New York, N. Y.

Mar. 13-15—ST. PAUL, MINN. (Lowry Hotel)
Minnesota Section A.W.W.A. Sec'y-Treas., R. M. Finch, 416 Flour Exchange Bldg., Minneapolis, Minn.

Apr. 7-10—CHICAGO, ILL. (Palmer House)
The National Ass'n of Corrosion Engineers. Exec.-Sec'y, Elton Sterrett, 905 Southern Standard Bldg., Houston 2, Texas.

Apr. 10-11—BUFFALO, N. Y. (Statler Hotel)
New York Section A.W.W.A. (Spring Meeting.) Sec'y-Treas., R. K. Blanchard, 50 West 50th St., New York, N. Y.

Apr. 17-18—CHICAGO, ILL. (Congress Hotel)
Illinois Section A.W.W.A. Sec'y-Treas., H. A. Tolburg, 2020 S. Fifth St., Springfield, Ill.

"SIMPLEX"
MEANS BEST
IN SEWAGE PLANT EQUIPMENT

TYPE "MO" FLOW METERS
AIR DIFFERENTIAL FLOW METERS
AIR METERS
SEWAGE PUMP TAPS
SEWAGE AIR RELEASE VALVES
RATIO CONTROL EQUIPMENT
PARABOLIC FLUME METERS
SEWAGE AND SLUDGE PROPORTIONAL CONTROL EQUIPMENT
SUMMATION METERS AND GAUGES
MANOMETERS
TYPE "MS" FLOW METERS
SEWAGE TYPE VENTURI TUBES

WRITE FOR FULL INFORMATION
SIMPLEX VALVE & METER CO.
6743 UPLAND STREET, PHILADELPHIA 42, PA.

Here and There with Doc Symons

Not long ago there was a farewell party at Avon, N. Y., for one of the swellest water superintendents a fellow could ever want to call his friend. W. H. "Bill" Clark retired after 43 years' service, and his son, Bill, Jr., took over. As I hear the story, there were more than a hundred "seventy" of the western N. Y. "gang" there, and with all of the appropriate speeches, food, and drinks, they toasted Bill and presented him with a beautiful watch.

A lot of people will remember Bill for one thing or another, but so help me (and I mean no disrespect), I'll always remember Bill Clark as the fellow who taught Bill Fenger and me how to play Honest Farmer, a swell way to stick your friends for the check. Yessir, a great sense of humor, which means he was a great guy as well as a great Supt. Sorry I missed the party, Bill.

* * *

The NEWWA Convention at Poland Spring, Me., was the first convention that Nellie LeVeque ever attended; her second day there was also their 22nd wedding anniversary. On that day, Rollie went out to play golf or something and locked Nellie in their room for the afternoon—I wonder why?

* * *

I understand that Harry Krum, Chief Water Fixer of Allentown, Pa., is still looking for a pair of B. Colis to mate. In case you didn't read of this need in the Sept. 1946 issue of the *Taste and Odor Control Journal*, write "Siggie" Sigworth for a copy.

* * *

It was during one of the Club Room sessions at the Toronto Meeting of the Federation, and I was engaged in some sprightly conversation (theirs, not mine) with some Canadian friends, when someone mentioned a slight bit of difficulty that had occurred in obtaining the liquid refreshments for the club room entertainment. Quick as a flash, Helen Ball, wife of O. V. "Ollie" Ball, Ontario Dept. of Health, and my favorite poet (or is it poetess?) came up with this quatrain:

'Twere better not to mention,
Nor draw undue attention,
To the liquor law evasion
For this glorious occasion.

And while we're on the subject of the club room, I suppose there are at least a dozen persons who wonder what my attitude is now after having seen the idea tried under a number of different circumstances. Tell you next month.

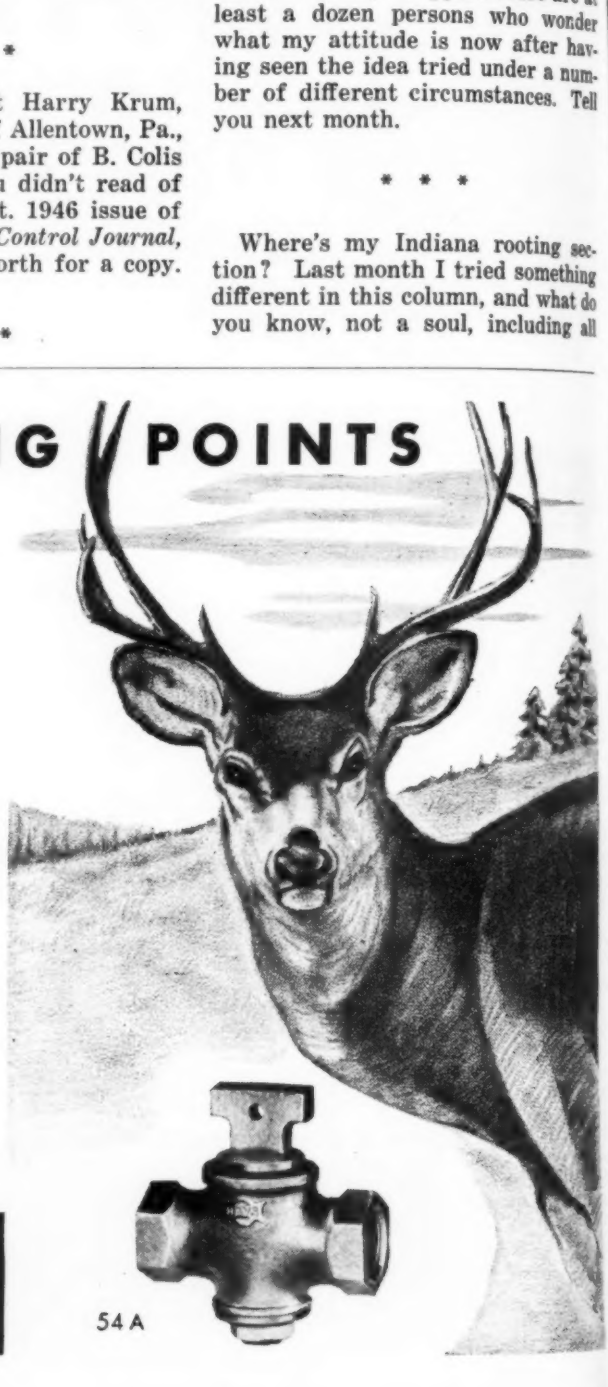
* * *

Where's my Indiana rooting section? Last month I tried something different in this column, and what do you know, not a soul, including all

10 OUTSTANDING POINTS

AS the value of the hunter's prize is measured by the number of points carried by his prey, so are Hays Fittings valued, not for one, but for the many points in which they excel.

(1) All Hays Water Works Stops are made of a single, uniform, high quality brass, 85-5-5-5 mix.
(2) Hays Fittings are made in a large and modern plant, equipped with the most up-to-date machinery, for the efficient handling of orders large or small, for regular or special items.
(3) Standard threading permits use in any standard threading machine.
(4) Every Hays Fitting is hydrostatically tested at 200 lbs. or more pressure.
(5) Hays plugs are individually ground in, to assure a perfect fit.
(6) Hays Stops are specially lubricated for lasting service.
(7) Hays Stops are designed to allow ample water-way.
(8) Hays Fittings are made by workers steeped in the tradition of the best American craftsmanship, many of them the sons and grandsons of past and present Hays employees.
(9) Hays offers a complete line, economically adaptable to your present system.
(10) Back of every order you place is the confidence built by over three quarters of a century of fair and generous dealing.



54 A

HAYS
COPPER · BRASS · LEAD · IRON
WATER WORKS PRODUCTS
HAYS MANUFACTURING CO., ERIE, PA.

that gang of Hot Shot Hoosiers, said a word. Speaking of comments from readers, I surely did appreciate a number of very personal comments at the Toronto Federation meeting, and believe me, what a kick I got when G. R. Goffin, of Brisbane, Australia, came up to me and said, "I'm glad to meet you in person; I read your stuff every month."

As to reader response, Jack Service, Editor of the *Sparling Metrograms*, wrote to say that he had the same qualms about readers until he offered copies of Sparling's "Tables of Water Equivalents," and had a flood of responses. Incidentally, if you haven't written Jack for a copy of those Tables, take a tip and do so.

* * *

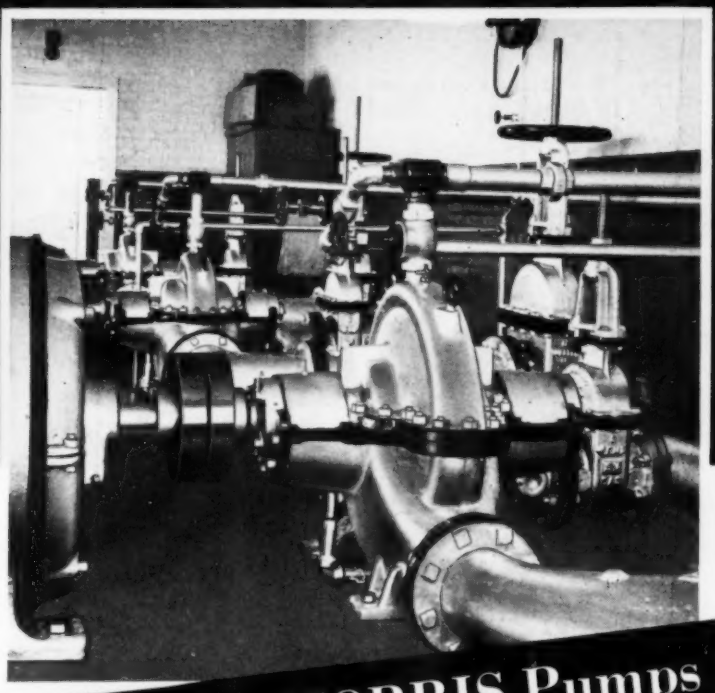
Ben Barton, whose experiences with garbage grinding makes wonderful stories, wrote me recently as follows: "Anent your colyumm on beautiful wimmen—did you see Mrs. Conrad of Wooster at the Ohio Sewage Conference in Akron?"—No—Sorry! But I did see a flock of 'em at the Federation meeting in Toronto—Dare I mention a few that I haven't mentioned anywhere before? —F'rinstance, Mrs. Fritz Friel, the new first lady of the Federation; Jacquelin "Aimant" Benoit, otherwise known as Mrs. Jacques (W & T, Montreal) Benoit; Nick Herda's "Child Bride" Erma (Nick superintends the Willow Run water and sewage works); Isabelle "Norsky" (Mrs. Jack) Wirts; Mrs. Bert Berry; Norma "Honey Chile" Schlenz, Hazel Wisely, "Jimmy" Larson; and—PLEASE, ladies, this column is only 1100 words long and the rest of you will just have to wait until there's space available.

* * *

Cy (W&T) Tygert sends this one in: Paul Molitor, Supt. of the Triboro Disposal Plant for Rutherford, East Rutherford, and Carlstadt, discovered a plate of false teeth in the grit chamber; the local newspaper reported the find and said the teeth were on display and could be claimed by the owner at the plant. A week later the newspaper reported that three telephone calls (all feminine) were received, each lady desiring more information on that upper plate. No one came to the plant and all three failed to divulge their names. Must be an epidemic of false teeth losing—My, my, the things that get into a sewer.

* * *

In the Modernized Water supply system at New Bern...



They rely on MORRIS Pumps

TWO reasons made it necessary for New Bern, N. C., to practically rebuild its water supply system—(1) a population which has doubled in a few short years, and (2) contamination by salt intrusion.

In the modernized New Bern Plant, one Morris 700 GPM, and two Morris 1400 GPM pumps—delivering water from storage tanks to the city's distribution system—have conclusively demonstrated their merits.

The 700 GPM pump is a 4″ unit with 5″ suction opening, and operates against a head of 143 feet. It is directly connected to a 40 HP, 1760 RPM motor. The 1400 GPM pumps are capable of pumping against a head of 165 feet, and are connected to 75 HP, 1760 RPM motors. These two units have 6″ discharge openings and 8″ suction openings. All pumps in this station are Morris standard, horizontally split design, bronze fitted, and the arrangement of the piping system is such that the two 1400 GPM pumps can at times be operated in parallel.

• Municipalities all over the country have learned to specify MORRIS pumps, because of their efficiency, economy, long life, and consistent output. Feel free to consult our engineers about your particular needs. For there is a MORRIS pump for every job, and more than three-quarters of a century experience behind every MORRIS installation.

Morris Machine Works, Baldwinsville, N. Y.

MORRIS *Centrifugal Pumps*

Offices in Principal Cities

While reading my favorite comic weekly, The U. S. Patent Gazette, I ran across a patent in the name of one Wm. Piatt of Durham, N. C., which reminds me that I missed seeing Bill at the Toronto meeting of the Federation. Kilroy wasn't there, either.

* * *

One of my Favorite Correspondents, Sam (II) Newkirk, of Elizabeth, N. J., certainly has been getting into the limelight recently. Not content with winning fourth prize in one of the Pittsburgh-Equitable Meter Contests and a consolation prize as a jingle writer (a feat duly recorded in the Elizabeth newspaper), Sam also had to make news by the fact that even when his water company has a leak in the mains, it's right where Sam can keep an eye on it. Yessir, the biggest leak in the system was right in Sam's front yard, or was that two other people, Sam?

* * *

From Sludge to Fudge: That dynamic spark plug secretary of the Central States Sew. Wks. Assn., John C. Mackin, has deserted us. No longer will he discourse on the values of sludge, activated or otherwise. Nowadays Johnny can be found dispensing fudge—sundaes, at "ye olde" Chocolate Shop, favorite lunching and refreshment place just off the University of Wisconsin Campus. I remember it well and, perhaps, Johnny, you'll see this alumnus there some time even if I don't see you at the Central States meetings. Good luck, and when you become an innkeeper, don't depend on George Martin to let me know. Do a little publicity work on your own behalf.

* * *

Some years ago I lived in a small mid-Illinois town. One of the local residents had just come back from his first trip to the Big City and was asked what he thought of Chicago. The old codger thought a minute and then remembering how he had seen so many garbage and ash trucks rumbling through the city, said brightly, "Great place, a bit windy, but they're awful behind on their haulin'." Well, I'm behind on my haulin', too, and you'll have to wait a month or so to catch up on the Toronto Convention; the NEWWA meeting; a letter from John Hood; stories about Stu Coburn, Fred Gibbs, Hall Hutton, Rollie Leveque, Mike Glace, Cliff Fore, Ted Kain, and a dozen others.

* * *

Hey, fellows—and girls—watch my December column for an unusual announcement.—V. T. Y. Doc.

Why Do These Things Happen to Me?

or

"Doc" Symons Apologizes to Everyone

This item is written by that fellow, "Doc" Symons, who writes the column "Here and There" published in the advertising section of this magazine. A year or so ago he published therein a bit of verse bemoaning the fate of the proofreader who let the typographical error slip by only to be discovered, after publication, by the editor and the readers. So what? So this item is to admit and apologize for too many such typographical and other errors in the last few months.

To begin with, in the July issue, page 292, **Dr. Harry Gehm's** excellent article on the work on paper and pulp waste treatment was marred by an illustration that was upside down.

THE BAILEY OPEN CHANNEL METER

1. Retains Accuracy
2. Self-Cleaning
3. Easy to Install
4. Easy to Maintain
5. Adjustable Capacity
6. Indicates, Records, Integrates
7. Totalizes Multiple Flows
8. Simple Chemical Feed Control
9. Rate of Flow and Ratio Control

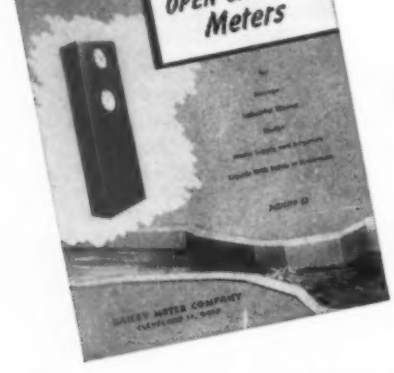
A Reliable Low Cost Meter for

SEWAGE

INDUSTRIAL WASTES

SLUDGE

IRRIGATION WATER



Ask For Bulletin 62

MU23

BAILEY METER COMPANY

1072 IVANHOE ROAD • CLEVELAND 10, OHIO

METERS and CONTROLS for SEWAGE and WATER

VENTURI TUBES, FLUMES, WEIRS, NOZZLES, ORIFICES • DIRECT MECHANICAL AND REMOTELY LOCATED REGISTERS • AIR-OPERATED, ELECTRONIC AND ELECTRIC CONTROLS.

Next month not one but two persons were mortified. On page 315 under the picture of **E. J. Beatty,** incoming President of Central States Sewage Works Assn., it stated that he was associated with the Wisconsin State Board of Health, when everyone knows that "Jack" Beatty left the State Bd. several years ago to become Supt. of Sewage Treatment at Neenah-Menasha, Wis.

In that same August issue on page 327, in reporting a paper on disease transmission, it said:

"In the absence of Robert N. Clark, his paper on 'Transmission of Disease by Sewage' was read by infectious source, second, a transmission channel, and third, a susceptible individual. . . .

"As factors in the transmission of disease, Mr. Clark named, first, an **Ed. LaValley,** Dist. Engr., N. Y. State Dept. of Health."

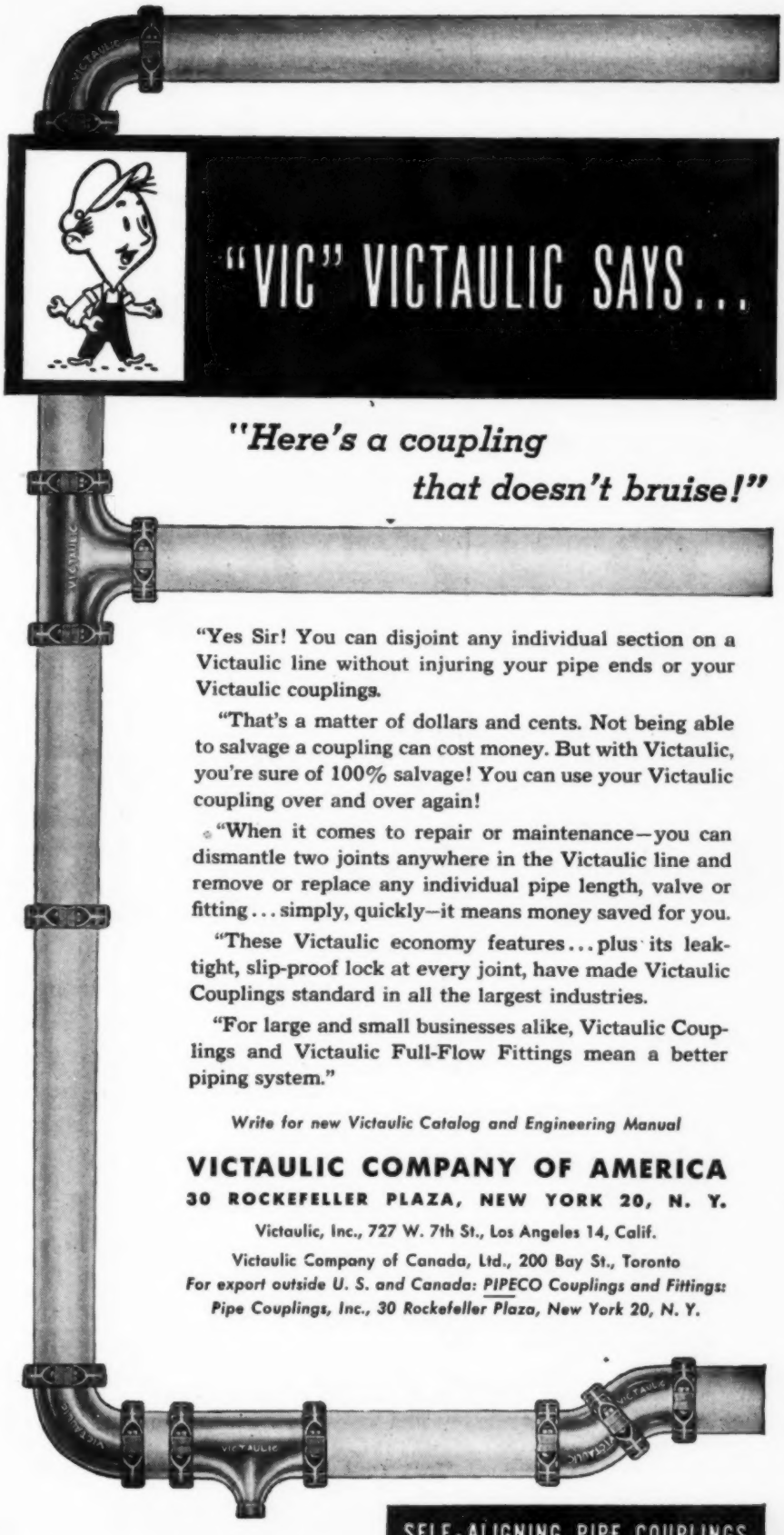
That switch in type lines brought a letter from Mr. C. A. Holmquist, Director of the Division of Sanitation of the N. Y. State Health Dept., who wrote: "Perhaps our Mr. La Valley has an apology due him!" Indeed, he does.

The September issue prepared to do service at two conventions, the N. E. W. W. A. meeting in Poland Spring, Me., and the F. S. W. A. meeting in Toronto, was to be a perfect job, *but* on page 374 the caption under one of the pictures spelled the name of Diamond Alkali's **A. F. Pawlik** with a U instead of a W. And on Adv. page 115, in an item telling about how **Daniel J. Atwell** had become New England Distr. Manager for the Dresser Manufacturing Division, his name was spelled with an I instead of an E, not once but three times—but this proved to be the fault of the news releaser who prepared the announcement.

To add insult to injury, the report on the Ohio Conference on Sewage Treatment at Akron, Ohio, in June failed to show a picture of **L. B. "Barney" Barnes,** new Vice President of that organization and longtime spark-plug Secretary. Of course, the reason was obvious; "Doc" Symons had taken another lousy picture, this one not even recognizable, let alone printable.

So far the only slip found in the October number is the labeling of **R. W. Simpson,** of Gilbert Associates, Reading, Pa, as R. N. Simpson—after R. W. worked with me for six years in Buffalo.

Why do these things have to happen to me? Sorry, boys, V. T. Y.—Doc.


"VIC" VICTAULIC SAYS...
"Here's a coupling that doesn't bruise!"
"Yes Sir! You can disjoint any individual section on a Victaulic line without injuring your pipe ends or your Victaulic couplings.
"That's a matter of dollars and cents. Not being able to salvage a coupling can cost money. But with Victaulic, you're sure of 100% salvage! You can use your Victaulic coupling over and over again!
"When it comes to repair or maintenance—you can dismantle two joints anywhere in the Victaulic line and remove or replace any individual pipe length, valve or fitting... simply, quickly—it means money saved for you.
"These Victaulic economy features... plus its leak-tight, slip-proof lock at every joint, have made Victaulic Couplings standard in all the largest industries.
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Have you considered Victaulic for your piping requirements?
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EFFICIENT FULL-FLOW FITTINGS
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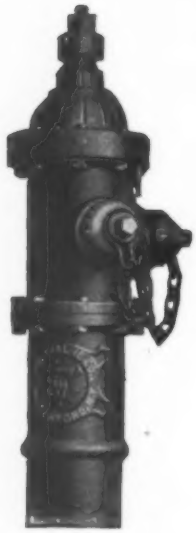
for permanent satisfaction—specify

Eddy
VALVES & HYDRANTS



"Permanent Satisfaction" is assured when you buy and install Eddy water works products. Three generations of men who "know how", assure that "permanent satisfaction" is built into every product that bears the name EDDY.

We have the valve or hydrant you want—chances are we have it in stock ready for immediate delivery. Specify EDDY — for "Permanent Satisfaction".

EDDY FOR LONG SERVICE

EDDY
VALVE COMPANY
WATERFORD, NEW YORK

MANUFACTURERS' and EQUIPMENT NEWS

New Clarifier for Turbid Water

To assure the maximum effectiveness of clarification in the shortest time, with great economy of space and chemicals, the Liquid Conditioning Corp. has developed the Liquon-Sludge Contact Reactor.

The unit combines the operations of mixing raw water with coagulants, agitating the mixture, and maintaining a suspended deep sludge bed or blanket or previously accumulated precipitates, while the clarified water is separated from the sludge and the sludge itself is concentrated for drawoff.

This Liquon-Sludge Contact Reactor may be used for coagulation of turbid, colored waters, for lime-soda softening, for removal of iron and manganese, silica or fluorides from water.

For further information on the unit and its application to specific requirements, address Liquid Conditioning Corp., 423 West 126th St., New York 27, N. Y.

Winners in Rockwell Contest Announced

The contest held by the Pittsburgh Equitable Meter Division of Rockwell Mfg. Co. to stimulate public thinking on the community advantages of 100 per cent water metering closed at the end of August and the winners have been announced.

The contest consisted of two parts, one to complete a jingle about universal metering, and the other to write an essay on the subject, "How a Community Is Benefited by Metering All Services."

Winner of the Jingle Contest was Miss Hazel V. Dennis, Baltimore, Md., who received $500. Second prize of $250 went to J. A. Plunkett, Cedar Grove, N. J.; third prize, $100, went to David W. Rudolf, Monterey Park, Cal., and Fred W. Smith, Gladstone,

Ore., received fourth prize of $50. Twelve consolation prizes of $10 each were also awarded.

In the essay contest W. W. Hurlbut, Los Angeles, was awarded first prize of $500. The $250 second award went to M. M. Gibbons, Rahway, N. J. Ted H. Kain, Columbia, Pa., won the third prize of $100, and Sam F. Newkirk, Elizabeth, N. J., won fourth prize of $50. Ten consolation awards of $10 each were made in the second contest.

Judges in the contest were W. W. Brush, Editor of *Water Works Engineering*; James H. Kennon, Water Commissioner of Pittsburgh; and Albert E. Paxton, Publisher of *Engineering News-Record*.

Gale Oil Separators and Conservation Systems

Industries that have been losing valuable oil down the drain, and municipalities that have been plagued with trouble caused by oil lost by industry should look into the Gale Oil Separators. Not only does the

Gale Oil Separator Co. make equipment for separating oil from waste waters, but it also produces equipment to recover oil for reuse, to neutralize pickling liquor acid wastes, and to clean water for reuse in industrial plants.

Illustrated herewith is a Gale system cleaning the effluent from the repair shops and roundhouses of a railroad. Units may be obtained for clarifying 2000 gpm. or units of 50 to 500 gpm. are also available. These units operate by gravity separation and the oil is taken off to compartments from which it can be removed to purification units.

These oil separators and conservation systems are manufactured by Gale Oil Separator Co., Inc., 52 Vanderbilt Ave., New York 17, N. Y.

J. D. Greensward to Work on Allis-Chalmers Expansion Program

James D. Greensward has been named assistant to William C. Johnson, vice-president of the general machinery division of the Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Mr. Greensward has been associated with the company since 1922 and has worked in several different divisions; for the last three years he was assistant to the treasurer in charge of contract terminations. In his new position Greensward will have important duties in Allis-Chalmers' expansion program.

Gardner Denver Appointments and Promotions

Promotions at the Gardner-Denver Co., Quincy, Ill., include the appointment of G. V. Leece, Vice President to General Sales Manager, and B. P. Spann, formerly Advertising Manager, to Personnel and Industrial Relations Director.

To replace Mr. Spann, the company has appointed D. P. Tunnicliff as Advertising Manager.

FOR
WATER CONDITIONING

SOLVAY
TRADE MARK REG. U. S. PAT. OFF.

For Water Softening

• • • SOLVAY SODA ASH

For Water Purification

• • • SOLVAY LIQUID CHLORINE

For Water Technical Service

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SOLVAY SALES CORPORATION
Alkalies and Chemical Products Manufactured by The Solvay Process Company
40 Rector Street New York 6, N. Y.

BRANCH SALES OFFICES:
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New Orleans • New York • Philadelphia • Pittsburgh • St. Louis • Syracuse

Hersey Dryers

At the Toronto meeting of the Federation of Sew. Wks. Assns. the Hersey Manufacturing Co. of South Boston had a display dealing with Hersey Dryers. These dryers are "Individually Engineered" for the purpose to which they are to be put. There are hot air dryers of counter-current flow and of concurrent flow; there are direct heat dryers, likewise of counter-current and concurent flow. Most of these two types of dryers have been developed and engineered for the drying of chemicals but the Hersey Intermediate Feed System, comprising a concurrent steam heated dryer with a cyclone type separator, had been used to dry fruit waste, starch, peat, sawdust, and sweet potato meal. These substances being somewhat similar to sewage sludge, it would appear that this type of dryer might have an application in this field.

The Hersey Co. offers a "Pilot Plant Pioneering" service free to all prospective users of Hersey Dryers. Perhaps consulting engineers and municipalities contemplating incineration of sewage sludge may find it advantageous to look into this pilot plant service.

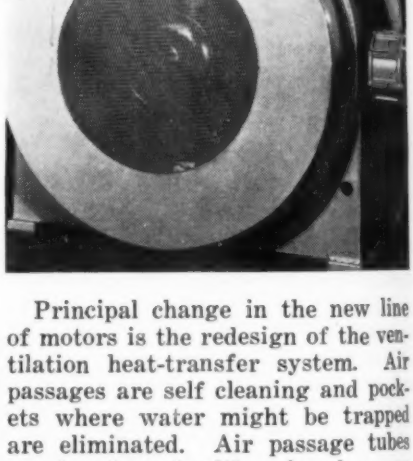
Write Hersey Manufacturing Co., Drying Machinery Div., E and Second Sts., South Boston, Mass.

Liquid Conditioning Corp. Appoints Representatives

The Liquid Conditioning Corp. of New York City, manufacturers of Liquon equipment for water softening and Liquonex Zeolites, has announced the appointment of engineering sales representatives: John B. Foley, Syracuse, N. Y.; Arthur W. Schuster, Rochester, N. Y.; Brookman-Hazel Associates, Buffalo, N. Y.; The Herr-Harris Co., Pittsburgh, Pa.; P. O. Stribling, Jr., Greensboro, N. C., and The Dorner Co., Milwaukee, Wis.

Allis-Chalmers Has New Outdoor Motor

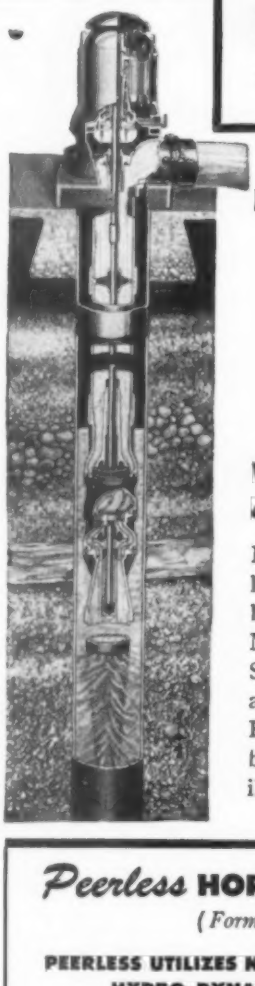
The Allis-Chalmers Mfg. Co., Milwaukee, has announced that it is now producing a complete line of outdoor weather-proof, totally enclosed motors in the larger sizes ranging up to and above 2000 hp.



Principal change in the new line of motors is the redesign of the ventilation heat-transfer system. Air passages are self cleaning and pockets where water might be trapped are eliminated. Air passage tubes can be cleaned with a brush or an air or water hose.

This unit is expected to find use in central power station plant service in connection with draft fans, and in chemical industry. It may also find use in sewage plants where ventilation and odor removal is a problem.

Write Allis-Chalmers, Milwaukee, Wis., for further information if interested.



PEERLESS PUMPS

Vertical and Horizontal Types

A FULL RANGE OF SIZES AND CAPACITIES

- **Built to serve Exacting Conditions of Waterworks, Sewage Disposal Plants, Aeration and Water Treatment applications, Highway Underpass installations, Cooling Tower service and Drainage and Dewatering.**

WORLDS OF WATER for MUNICIPAL USES *with* PEERLESS VERTICAL TURBINE PUMPS

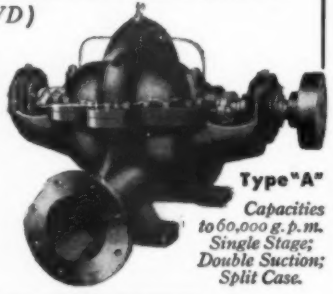
Developing capacities from 15 to 30,000 g.p.m., against heads up to 1,000 feet, Peerless Vertical Deep Well Turbine Pumps assure a constant and clean water supply. Many exclusive engineering features, such as Double Seal – Double Bearing Bowl Construction, give added assurance of long life and maintenance of efficiencies. Peerless Deep Well Turbine Pumps are available in both oil or water lubricated types (water lubricated illlustrated) and are adaptable to all forms of drive.

***Peerless* HORIZONTAL CENTRIFUGAL PUMPS**

(Formerly DAYTON-DOWD)

PEERLESS UTILIZES NEW PRINCIPLES OF HYDRO-DYNAMIC DESIGN!

Capable of continuous low-cost service and maintained efficiencies, Peerless Horizontal Pumps are available for practically every variety of general pumping service. Peerless Engineers are available to recommend the proper pump size and drive to meet your requirements.



Type "A"
Capacities to 60,000 g.p.m. Single Stage; Double Suction; Split Case.

PEERLESS PUMP DIVISION

FOOD MACHINERY CORPORATION

Los Angeles 31, California • Quincy, Illinois • Canton 6, Ohio

Distributors in all Principal Cities

PEERLESS PUMPS

Dr. Hatch Studies Banox for Calgon

G. L. Illig Appointed to Research Staff

Dr. George B. Hatch, who for the past ten years has specialized on detergents and threshold treatment, has been assigned by Calgon to research on Banox, the company's new product for protective treatment of metal surfaces.

Dr. G. B. Hatch

G. L. Illig

Banox is an inexpensive low temperature phosphate coating suitable for dip or spray application, has been used primarily for the protection of steel and galvanized surfaces from corrosion prior to finishing, and to obtain a more durable bond for paints and lacquers.

The company has also appointed to its staff George L. Illig to concentrate on process development.

Atlas Mineral Products Has Affiliate

The Atlas Mineral Products Co., manufacturers of Acid- and Alkali-Proof Cements and floors of similar nature, plastic linings, jointing materials, and protective coatings, has announced the formation of an affiliate organization, The Atlas Mineral Products Co. of Texas. The new affiliate organization includes a manufacturing plant for sulfur cements and other firm products and is located in Houston, Texas.

Lithcote Applications to Be Broadened

Lithcote, the corrosion-resistant coating and lining material manufactured by the Lithgow Corp., has been taken over by the Bedford Development Corp., 230 Park Ave., New York.

This lining, which is baked on equipment as a non-porous, glass-like surface, has been used on processing tanks for foods, distillery and brewery tanks, petroleum, chemicals, etc. It may find use in chemical tanks for storing ferric chloride, alum, or other chemicals in water and sewage plants.

Information may be obtained from the Bedford Development Corp., 230 Park Ave., New York.

New Ideal Flashlight

Ideal Industries, Inc., Sycamore, Ill., has announced a new plastic non-breakable flashlight. Light in weight, shock-proof, water-proof, with unbreakable lens, this new flashlight has many advantages and features which make it of interest to water and sewage works operators.

Write Ideal Industries, Inc., Sycamore, Ill., for further information on this new flashlight.

Pennsalt Shifts Sales Chiefs

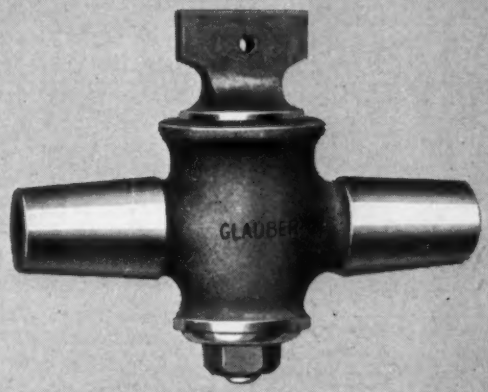
Louis M. Kuilema, formerly district sales manager at the Cincinnati office of Pennsylvania Salt Mfg. Co., has been placed in charge of the Wisconsin territory as district sales manager and will have his headquarters in Chicago.

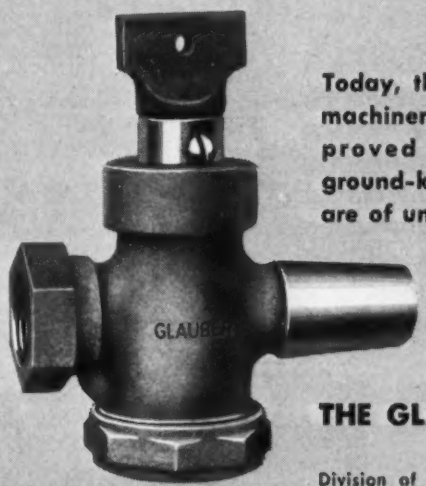
To replace Mr. Kuilema in Cincinnati, Charles W. Dermitt has been appointed as Sales Manager for that district.

Glauber CAN MEET YOUR REQUIREMENTS FOR QUALITY GROUND-KEY CURB STOPS

K1080 — right — Curb stop with solid brass tee handle, round way and lead pipe both ends.

K-1084 — below — Inverted key curb stop with loose tee handle. Round way, inside iron pipe thread to lead pipe.





Today, through the installation of new machinery and the development of improved foundry methods, Glauber ground-key curb and corporation stops are of unsurpassed quality. These same production improvements are stepping up production of all types in an effort to meet current municipal requirements. For quotations write . . .

THE GLAUBER BRASS MFG. CO.
Kinsman, Ohio
Division of H. B. Salter Mfg. Co., Marysville, Ohio

Glauber RED BRASS
GROUND-KEY CURB and CORPORATION STOPS
LEAD GOOSENECKS and WATERWORKS FITTINGS

LET IT SNOW!

As a device on which life and property are constantly dependent, a hydrant, to be worth while, must perform when needed. And Winter is the time Mathews Hydrants best prove their merits. They are so constructed that when the ground freezes, the tough Sand-Spun protection case has free vertical movement — the protection case, *not the joint*, takes the strain. Drainage is always complete. And the working-parts are kept permanently dry.

You can measure the life of Mathews Hydrants in generations, not years, as proved by the many old units still serving. Their principle is sound, their construction simple yet rugged, and into them goes more than 75 years' experience in design and manufacture.

Send for illustrated booklet, *describing in detail the removable barrel, the revolving head, and the other distinguishing features. It shows the reasons why there are some 400,000 Mathews Hydrants in use in the world today.*

MATHEWS HYDRANTS

Made by **R. D. WOOD** *Company*

PUBLIC LEDGER BUILDING
INDEPENDENCE SQUARE, PHILADELPHIA 5, PA.

MANUFACTURERS OF SAND SPUN PIPE (CENTRIFUGALLY CAST IN SAND MOLDS) AND R. D. WOOD GATE VALVES

IMPROVED JOINTING COMPOUND

Tegul-MINERALEAD

for Bell & Spigot Main

- Sulphur base; quick sealing, speeding laying and backfilling.
- 10 lb. ingot form, easily handled, stored and shipped. Impervious to rain. Cannot change composition.
- Makes permanently tight joints. Goes 3 to 5 times as far as lead, helping conserve a strategic war metal.
- For money-saving information, write

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Mertztown, Pennsylvania

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A Filter Medium For All Purposes

ANTHRACITE EQUIPMENT CORP.
101 Park Ave. New York

All correspondence regarding sales and engineering should be addressed to:

PALMER FILTER EQUIPMENT CO.
822 E. 8th St. Erie, Pa.

Engineers and Sales Agents

Precipitators to Abate Smoke Nuisance

Koppers Co., Inc., have announced the production of the Koppers-Elex Electrostatic Precipitator, a new piece of equipment that will remove fly-ash, acid mists, chemical dusts, etc., from plant discharge gases.

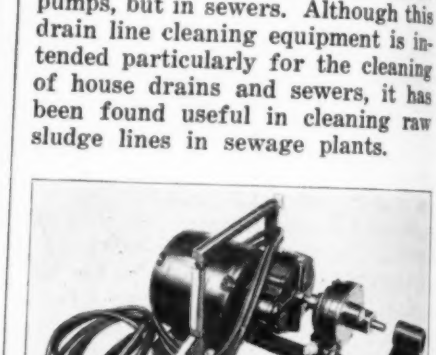
The device, being built at the Bartlett-Hayward Plant of the company, is a Swiss-invented apparatus, for which the Koppers Co. has acquired exclusive manufacturing rights.

As yet these units have not been applied to the smoke from sewage sludge incineration but municipalities which feel that this is an atmospheric pollution problem might well look into these new units. Municipalities definitely faced with an atmospheric nuisance of chemical fumes might likewise find these units of interest.

The Koppers Company, Inc., is located in the Koppers Bldg., Pittsburgh, 19, Pa.

The Electric Eel

Eels in water works pumps have caused considerable trouble to many operators, but the Electric Eel, as manufactured by the Ohio Tool & Engineering Co., is designed to eliminate trouble, not in water pumps, but in sewers. Although this drain line cleaning equipment is intended particularly for the cleaning of house drains and sewers, it has been found useful in cleaning raw sludge lines in sewage plants.



One of the large eastern sewage works has recently purchased one of these units and is using it successfully in cleaning raw sludge lines leading into digesters. Built with a double cable for strength and safety, the unit can be used with various tools for cleaning lines from 1¼ to 6 inches. Larger lines require special tools.

Further information on this piece of equipment may be obtained from the Ohio Tool & Engineering Co., 277 Broadway, New York 7, N. Y.

Wheelco Opens Indianapolis Office

A new office under the direction of John E. Anderson has been opened by Wheelco Instruments Co., at 107 So. Capitol Ave., in Indianapolis, Ind. The Indianapolis office will serve the greater portion of Indiana, Western Ohio and Kentucky.

Airborne Water Witch

Harold D. May, well driller of Tampa, Fla., has purchased a small plane in which he scouts faults in the earth's surface formation to locate drilling sites to provide water for Florida's citrus industry.

Mr. May has 13 trucks and four rigs for drilling purposes, and most of the wells drilled are 12 inches in diameter and from 700 to 1400 ft. deep. Most of the citrus growers need wells producing from 1000 to 2000 gpm.

This means of spotting drilling locations is unique, and so far as is known, Mr. May is the first well driller to employ an aeroplane in this connection.

Small Self-Priming Vane Pump

The VW-1 Type 203 Vane Pump, manufactured by the Eastern Engineering Co. of New Haven, Conn., is a small pump designed to pump approximately ½ gallon per min. suitable for operating pressures from 0 to 30 lb. per sq. in.

The pump is self priming, and the construction incorporates two composition bearings requiring no lubrication beyond that furnished by the liquid being pumped. By means of a special design of vanes and applying the proper radii to the vane edges, the vanes are held in contact with the pump chamber walls and require no centrifugal force to maintain volumetric efficiency.

The unit is specifically designed for use in systems having a relief valve and no bypass is built into the pump design. Shaft sealing is accomplished by a mechanical rotary seal.

This unit should find application in water plants in connection with sampling different parts of the water plant. It may also have use as sampling pump in a sewage plant but this use is subject to further investigation.

Write to the Eastern Engineering Co., 45 Fox St., New Haven 6, Conn.

John D. Rue Works Mgr. Hooker's Tacoma Plant

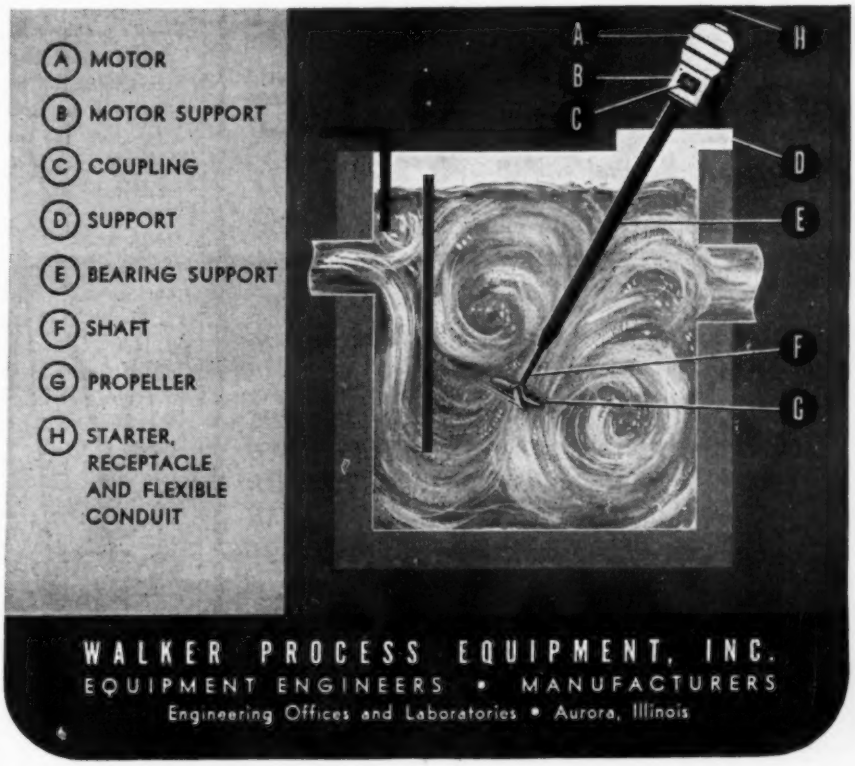
The Hooker Electrochemical Co. has announced the appointment of John D. Rue as Works Manager of its Tacoma Plant. Mr. Rue has been associated with the company since 1931 and prior to that time he was in charge of the Pulp and Paper Section of the U. S. Forest Products Laboratory at Madison, Wis. He is widely known for his work in the use of chemicals in the manufacture and bleaching of pulp and paper.

IN WATER PURIFICATION

ASSURE IMMEDIATE AND COMPLETE REACTION OF CHEMICALS INTRODUCED

THE PROQUIP PROPELLER MIXER PROVIDES THE ANSWER

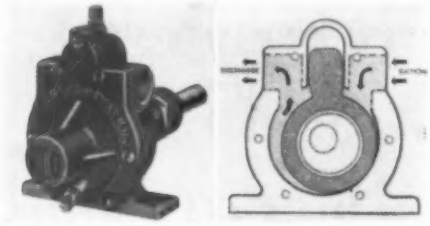
In mixing for chemical reaction, violent agitation to provide the most intimate contact of chemicals and liquid is an absolute "must". To assure circulation and turnover throughout the tank, specify PROQUIP Propeller Mixers. Easily swung to the top of tank by one man, this mixer offers outstanding performance. Write us for Bulletin 2S2.



WALKER PROCESS EQUIPMENT, INC.
EQUIPMENT ENGINEERS • MANUFACTURERS
Engineering Offices and Laboratories • Aurora, Illinois

ECO Gearless Pump

We think perhaps we've found another pump for sewage sampling. Not that the manufacturer advertises it as such, but the ECO Gearless Pump would seem to have good possibilities for that purpose. Small, inexpensive, having a resilient nonmetallic impeller, this pump, which operates at from 600 to 1800 rpm. and can run in either direction, will



pump from 3.5 to 10 gpm. with a ½ inch connection. In the case of the double impeller pump with a 1-inch connection, the capacity at 1800 rpm. goes up to 23 gpm.

A general purpose pump suitable for many uses in mills, factories and homes, this unit which will pump oil, water, brine and many other liquids, has special construction to overcome injury to the pump from liquids containing abrasive or solid particles. The pump is of non-corrosive bronze throughout and needs no lubrication or adjustment. In water and sewage plants this new kind of pump should find use for pumping lime slurry, water and sewage samples, chemicals not corrosive to bronze, activated carbon, and so forth.

We suggest that you write the ECO Engineering Co., 12 New York Ave., Newark 5, N. Y., for information on this pump, which may be your answer to some of your problems.

Materials Handling Exposition in Cleveland in January

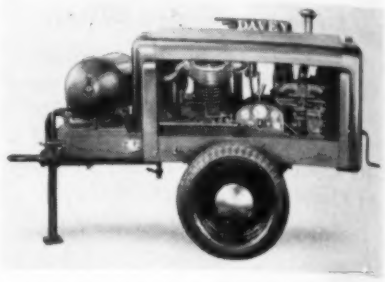
At the first national Materials Handling Exposition to be held at the Public Auditorium, Cleveland, Jan. 14-17, the problems of handling materials in water and sewage works will be among those receiving attention.

On exhibition will be hoists, hoist mountings, cranes, derricks, conveyors, hand and power trucks, skids, tractors, and trailers. All phases of materials handling will be discussed during the four day meeting. Water and sewage works problems will be among those discussed.

Admission to the sessions may be obtained from the exposition management, Clapp & Boliak, Inc., 37 Wall St., New York, N. Y.

New Portable Compressor

The Davey Compressor Co., Kent, Ohio, has announced a new Model 60V portable compressor for 1947.



The new unit is available in standard skid and 2-wheel pneumatic trailer mounting styles. It is also offered as an Auto-Air compressor for truck mounting. The compressor produces 60 cfm. at 100 lb. pressure and is designed for heavy duty service.

Further information may be obtained from the Davey Compressor Co., Kent, Ohio.

RUST & BITUMINOUS ENAMEL CORROSION

There is only one means of permanent protection against the inroads of oxidation — that's *Bituminous Enamel*

We are nationally known approved Applicators of Bituminous Coatings for treating Steel Standpipes, Elevated Water Tanks, Water Mains, Penstocks, Lockgates and other Water Works installations.

IN CASES REQUIRING CATHODIC PROTECTION, WE RECOMMEND BITUMINOUS COATINGS TO ELIMINATE CORROSION AT WATER LEVELS AND ABOVE.

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How often has this happened to you

You've seen it happen —it's probably happened to you! The uncertainties of pipe ramming or jacking frequently end up in serious losses of time and materials.

New hi-powered models bore 2½ to 14½ inch hole—FAST!

Write for Engineering Data and Illustrated Booklet

IT CAN'T HAPPEN WHEN YOU USE A HYDRAUGER

because Hydrauger drills and reams clean, open-hole under accurate target-control. Hydrauger-ing avoids a tremendous amount of pavement-cutting, trenching, compaction, etc. Hydrauger-ing is the ideal way to install wrapped pipe, or any water or sewer lateral.

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HYDRAUGER CORPORATION, LTD.
116 NEW MONTGOMERY STREET
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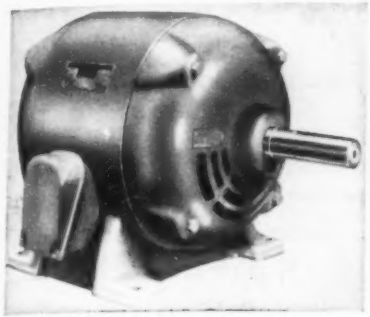
Westinghouse Squirrel Cage Induction Motor

Known as the "Life-Line" Motor, Westinghouse's new squirrel cage induction motor with its all steel construction makes possible a motor that is 35 per cent smaller in size without sacrifice of electrical properties.

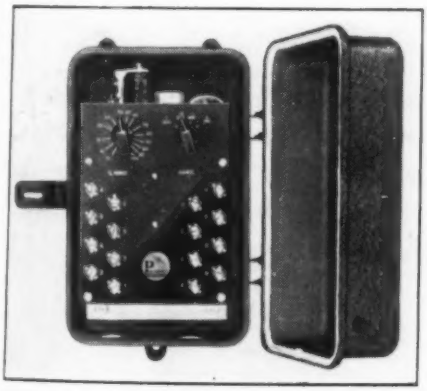


The new motor is available in sizes from ½ to 20 hp., in voltages of 208, 220, 440, and 550, in two and three phase; in frequencies of 60, 50 and 25 cycles with several speeds in each frequency. The motors are obtainable in NEMA Standard dimension frames 203 to 326.

Information on these new motors may be obtained from the Westinghouse Electric Corp., 306 Fourth Ave., Box 1017, Pittsburgh 30, Pa.

New Electronic Timer

Photoswitch, Inc., has announced the production of a new Electronic Timer, Type 30HL1, an automatic timer for intervals from 1/20th second to four minutes. It is recommended particularly for process control and machine timing where long



life, repeat cycle operation, or precise accuracy is a prerequisite. This timer provides four basic types of timing: interval, delayed action, automatic repeat, and programming, as well as variations of these four fundamental types. Accuracy is maintained to 98 per cent or better.

CEMENT GUN COMPANY
"GUNITE" CONTRACTORS
GENERAL OFFICES—ALLENTOWN, PENNA., U.S.A.

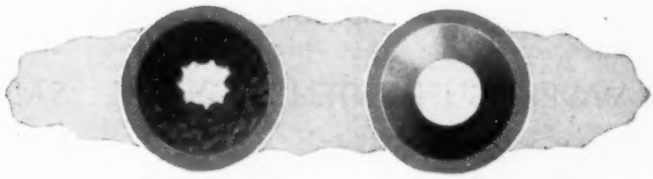
DAM REBUILT WITH "GUNITE"

This is Lower Doughty Pond Dam belonging to the Atlantic City, New Jersey, Water Department, a poured concrete structure with fresh water upstream and tide water at the downstream toe. This structure became seriously disintegrated and eroded as shown in the left hand photo, and was completely restored with "GUNITE" a minimum of six inches in thickness with double mesh reinforcement.

The right hand view shows the finished job completed by us in 1941. Both the upstream and downstream faces were restored with "GUNITE," as well as the wing walls.

Our 72-page general bulletin C2300 describes this and scores of other uses of "GUNITE." We will be glad to send it to you upon request.

MANUFACTURERS OF THE "CEMENT GUN"



Before Cleaning — After Cleaning

The Trade Mark of a Nation-Wide Organization

From Washington, D. C., to the Pacific, North, South, East and West, National Water Main Cleaning experts stand ready to serve you —guaranteeing to restore your mains to 95% of original capacity.

For as many as 40 years—longer than most water works men have been engaged in their professional work, National Water Main Cleaning Company has been building up an organization of engineers trained in the art of rehabilitating water lines.

This "95% performance" is now accomplished more quickly and with less disturbance to your normal operation than was ever possible before.

To put your water distribution system into first class condition for maximum service get in touch with our nearest office.

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Manual de

INGENIERIA SANITARIA

1946

1947 EDITION NOW IN PREPARATION

for the

LATIN AMERICAN MARKET

Second Annual Edition

The 1946 edition of this new Reference and Data Catalog, specializing in water and sewage field, was given an enthusiastic reception by Latin American engineers, public officials and equipment and supply distributors.

CULTIVATE THIS EXPORT MARKET

Water supply systems are being increased and improved. Particular attention is being given to areas along strategic highways; around airports and shipping centers. Manufacturers of supplies and equipment to serve water and sewage fields will find this export market worth cultivating.

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Manual de INGENIERIA SANITARIA is designed to serve as a practical Reference and Data book for the men in Latin America charged with the problems of water supply and sanitation. It is printed in Spanish and offers access to one of greatest potential markets in the world today. The Manual is comparable to the English edition of the Reference and Data issue of Water & Sewage Works. It is a handbook of informative data and a buyers' guide.

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Versatility

VAR-I-FEEDER injecting Calgon at Veterans Administration Hospital, West Roxbury, Mass.

From low priced constant feed models to proportional meter-controlled units for flow responsive treatment of variable flows, adjustable without interrupting pumping process, Var-I-Feeder is the chemical feeder for the job. Versatile Var-I-Feeders are available in all these types, plus units specially engineered for individual applications.

Var-I-Feeder is ordinarily electric motor driven, but can be easily adapted for belt connection to revolving shaft or pulley with electric motor omitted. If electricity is not available, any available RPM will do. Hydraulic and air-pressure driven units may also be provided if specified.

Look at the listing below that proves Var-I-Feeder versatility:

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Alum Feeding • Caustic Dosage • Hypochlorination • Aqua Ammoniation • Soda Ash Treatment • Swim Pool Water Treatment • Calgon for Corrosion Control • Chlorine Dioxide for Taste and Odor Control • Sterilization with HTH, Perchloron, Pittchlor or Bleach

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ANY OTHER CHEMICAL SOLUTION USED IN — Water Works • Sewage Plants • Tourists Camps and Cabins • Swim Pools • Soft Drink Plants and Breweries • Textile Mills • Dairies • Laundries • Boiler Feed-Water Conditioning.

We construct and install special units for any industrial liquid process.

CHEMICAL FEEDERS DIVISION
Morse Boulger Destructor Co.
ROOM 1700B, 205 E. 42 ST.
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Providence Office, 250 Auburn St., Cranston, R. I.

The new timer will operate on 115 or 230 volt, 50 or 60 cycles. Its net weight is eight pounds.

For further information on Photoswitch Electronic Timer Type 30HL1, write to Photoswitch, Inc., 77 Broadway, Cambridge 42, Mass.

Stainless Steel Gates

Do you know anyone who has the problem of controlling acid or corrosive stock? Perhaps some of our industrial readers do. If so, they

may be interested in the Rodney Hunt New Stainless Steel Gates which are not affected by process waters or waste.

For complete information write the Rodney Hunt Machine Co., Water Controlling Apparatus Division, Orange, Mass.

Airfoam-Generating Nozzle for Fire-Fighting

Water works are always well aware of fires but seldom are faced with fires within their own plants. Sewage works, too, seldom have fires, yet both provide fire protection and for that reason may be interested in a new, novel Airfoam generating nozzle, which mechanically creates Airfoam through a scientific mixing of water, air, and Foamite Airfoam Liquid within the nozzle, and discharges the combined ingredients as Foamite Airfoam through the nozzle tip.

More information on this new nozzle which is especially ideal for extinguishing fires in flammable oils, paints, varnishes, etc., may be obtained from the American-La France-Foamite Corp., Elmira, N. Y.

• 1879 •
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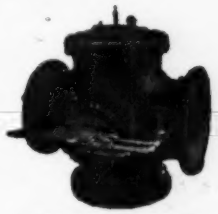
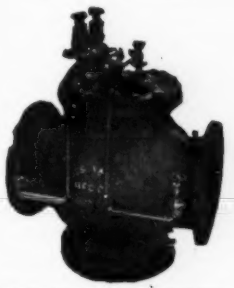
AUTOMATIC VALVES

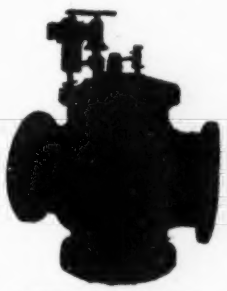
• ALTITUDE VALVES • SURGE • RELIEF • BACK PRESSURE VALVES •



ALTITUDE VALVES
for
Control of elevation and heads into and out of tanks, basins and reservoirs, hydraulic control.
1. Single acting.
2. Double acting.
3. Combination assembly for three or more automatic operations.
4. Can be equipped with electric and manual controls.



COMBINATION VALVE
This valve will permit flow in one or both directions acting as
1. Pressure Reducing and Altitude Valve.
2. Pressure Reducing and Altitude Valve.
3. Relief and Altitude Valve



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Electric remote control—solenoid or motor can be furnished.
Adapted for use as primary or secondary control on any of the hydraulically controlled or operated valves.

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Large stock enables us to make prompt shipments.

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SIZES 2" TO 84"

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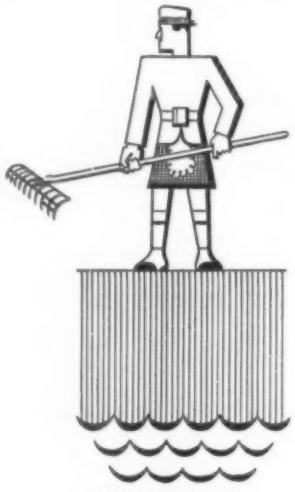
RODNEY HUNT'S



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The latest and best in water controlling apparatus. 1. The improved Rodney Hunt POWER-SAVER Trash Rack, with welded Back Bar Construction. Strong, easy to clean, quick to install, protected against corrosion. 2. Rodney Hunt's POWER-SAVER Buoyant Trash Rakes, with non-corrosive stainless steel heads, and the new "Feather-lite" tubular handle. Almost effortless operation. For the complete story—

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STEEL FORMS for CONCRETE METER BOX TILES

You can make excellent meter box barrels at low cost with one of these steel forms. They are made in several sizes and lengths.

Let your post-war plans include making good use of one or more of these forms. Make a start now by asking for information.

FORD Meter Box Co.

WABASH, INDIANA

LITERATURE AND CATALOGS

Latin American Sanitary Engineering

A recent news release folder issued by the Gillette Publishing Co. of Chicago calls attention to the 1947 edition of the **Manual de Ingenieria Sanitaria,** now in preparation and scheduled for publication next spring. The 1946 edition was acclaimed throughout Latin America among its more than 3500 readers. *Ingenieria Sanitaria* is the Latin American counterpart of the Reference and Data issue of *Water & Sewage Works*, and contains formulas, charts, tables, diagrams, and articles on fundamentals in the science of sanitary engineering, and the maintenance and operation of water and sewage works. The book itself is entirely written in Spanish, but the folder describing it is in English.

If you are interested in information on this manual write to the Gillette Publishing Co., 22 W. Maple St., Chicago 10, Ill.

Flow Responsive Equipment

For continuous treating, sampling, blending or diluting in process operations, %Proportioneers, Inc.% recommend their automatic flow responsive equipment and methods as described in their Bulletin No. 1200, titled **Treet-O-Control.**

This new bulletin catalog is a handy reference book and contains pertinent information on the design, construction, application and use of %Proportioneers% equipment which by combining fluid meters and proportioning pumps makes a given process continuous.

The %Proportioneers% method is clearly explained and the operation of the equipment is demonstrated by two-color diagrams. From tables and data in the bulletin it is possible for a purchaser to select and size equipment for most treating, sampling, blending, and diluting applications. If the maximum line flow and the maximum requirement for secondary fluid flow are known, the equipment needed can be picked.

Examples of applications include

No caulking . . . no need to dig large bell holes . . . . large savings

Haymanite

THE PERMANENT, SELF-SEALING JOINTING COMPOUND FOR BELL AND SPIGOT CAST IRON WATER MAINS

FREE
ILLUSTRATED BULLETIN

Explains: how Haymanite reduces labor and material costs; how any workman can make permanently tight joints; how fewer tools are needed; how leaks are reduced; why vibration is no threat.

Producers also of
M. H. Brand Caulking Lead

MICHAEL HAYMAN & CO.,
INCORPORATED
ESTABLISHED 1869
870 EAST FERRY ST.
BUFFALO, N.Y.

MR. SUPT:—

Sure! You can superchlorinate and avoid high residual chlorine taste when—

you post-treat with Virginia's "ESOTOO".

Write us today.

VIRGINIA SMELTING COMPANY
WEST NORFOLK, VIRGINIA

the addition of corrosion inhibitors, coagulating chemicals, disinfecting agents, softening agents or pH adjustment, boiler water treatment, and for that matter addition of any or all chemicals and agents for the treatment of water and sewage.

A copy of bulletin may be obtained from % Proportioneers, Inc., % Providence 1, R. I.

Disc Meter

A new bulletin with detailed description of the **Arctic Type Pittsburgh Disc Meter** has been released by the Pittsburgh Equitable Meter Division of Rockwell Mfg. Co.

Meters in 5/8-in., 3/4-in., and 1-in. are described and full scale cutaway photographs show the major parts and the construction features graphically. A three page section is devoted to repair parts. Exploded views in which all operating parts are shown as they are assembled simplifies ordering of replacement parts. These views also serve as an assembly guide for the repair man.

Write to the District Office of the company in your territory or to Rockwell Mfg. Co., 400 North Lexington Ave., Pittsburgh 8, Pa., for a copy of bulletin W-804.

Two Stage Pumps

Catalog C746 of Economy Pumps, Inc., is devoted to high efficiency, ball bearing type DMD, two-stage pumps. Made in capacities from 75 to 700 gpm. for heads from 175 to 400 ft. at 1750 rpm., these pumps are suitable in all clear water services where pressures of 100 to 170 pounds are required.

If you are interested in water supply for high buildings, for small municipalities, for industrial and process plants, boiler feed, etc., write Economy Pumps, Inc., Hamilton, Ohio, for Catalog C746.

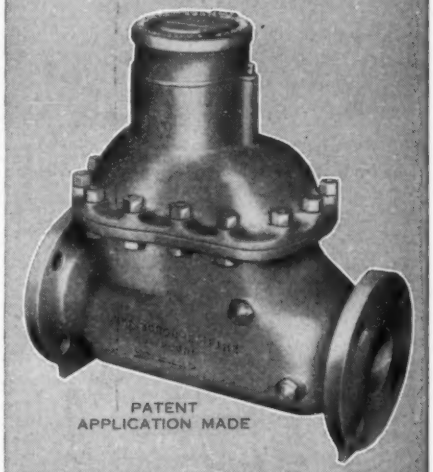
Gate Valve Operation

We can remember back to the days of our youth when we were a filter plant operator; back in the days when to open a large gate valve meant back-breaking work for minutes that seemed like hours, and often were hours. We feel sorry for men in water and sewage works today, for they'll never have the memory of lugging that heavy key to the valve box and then going 'round and 'round and 'round until they drop from exhaustion.

Have you seen?

the PITTSBURGH · EMPIRE COMPOUND

a revolutionary NEW meter with many advantages



Ask for Bulletin W-803

Pittsburgh Equitable Meter Division
ROCKWELL MANUFACTURING CO.
Pittsburgh 8, Pa.

FEEDS-METERS-MIXES CHLORINE GAS ACCURATELY

SterElators by Everson

PURIFICATION FOR WATER-SEWAGE & SWIMMING POOLS

Everson SterElators Operate Manually or Semi-Automatically, Also Automatically Proportion Gas Flow to Water Flow.

Everson SterElators Utilize a 24" Water Gauge Vacuum and Visible Flow Meters, with Wide Ratio Ranges of Capacities: 10 to 1, 50 to 1, 110 to 1.

All SterElators Are Dependable, Accurate, Safe and Easy to Operate. Guaranteed to Give Complete Satisfaction.

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HYDRO-TITE — The self-caulking joint compound that makes cast iron water pipe joints — strong — tight — flexible and everlasting. Used on thousands of miles of pipe with a record of more than 30 years without a failure.

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FIBREX — The sanitary paper packing that is used like braided jute. Free from bacteria — treated with a water repellent — put up in 60 pound reels. 70 pounds of Fibrex takes the place of 100 pounds of braided jute.

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HYDRAULIC DEVELOPMENT CORPORATION
50 Church St.
New York, N. Y.

DRY BRAIDED
Fibrex

That is, they won't have that memory if they go in for **Gate Valve Operation** in the modern manner with a Dean Power Truck. In a 12-page bulletin, Payne Dean & Co. has shown the electric power truck which can be used for floor stand operation by flexible shaft or for operating valves under the floor or underground.

In addition to specifications for the Dean Power Truck, the bulletin shows an electrically operated floor stand and a special heavy duty hand operated floor stand, floor stands, angle drive units, electrically operated gate controls, control switches, new type gate valves, and the Dean Operating Truck.

This bulletin may be obtained from Payne Dean & Co., Madison, Conn.

Booster System

In a new 16-page catalog (Bulletin 1500) on **Water Supply and Booster Systems,** Yeomans Bros. give complete data on determining head and capacity requirements, selecting the proper system and pumping equipment, typical piping and pump installations, and approximate dimensions for layout purposes for booster systems for buildings and for water supply.

Write for Bulletin 1500 to Yeomans Brothers Co., 1468 N. Dayton St., Chicago 22, Ill.

Screens and Perforated Metals

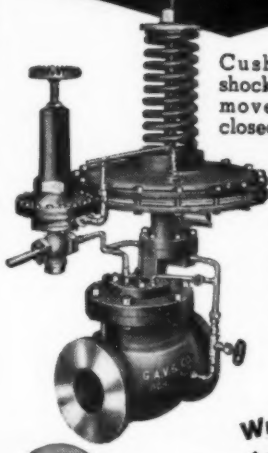
In a beautiful book issued recently by the Hendrick Manufacturing Co. to commemorate seventy years of experience, the company has prepared an outstanding catalog of **Perforated Metals, Screens, Fabricated Metals.**

One might expect that the only interest of water and sewage works operators in the products of this company would be the Wedge Slot Screen, but that is not true. Other items of particular interest to this field are vibrating screens, strainers, testing screens, flights, elevator buckets, open steel flooring, stair treads, breeching, as well as many of the ornamental screens.

There are 18 pages of useful tables, as well as page after page of examples of perforated metal, pages showing the different kinds of perforations, round, square, hexagonal, squaround, diamond, slots, mushroom, burred, and nozzle. There is a section on the relation of shape of perforation and screening capacity.

We suggest you write the Hen-

GOLDEN-ANDERSON
Single Acting Differential
ALTITUDE
VALVES



Cushioned against shock or jar as valve moves into open or closed positions. Needle valve control will instantly regulate speed of operation to existing pressure condition. 150 lb. to 400 lb. working pressure.

Write for Descriptive Catalog

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GOLDEN-ANDERSON
VALVE Specialty Company
PITTSBURGH 22, PA.

PULSAFEEDER
CHEMICAL PROPORTIONING PUMP

★ For hypochlorination, ammoniation, and continuous chemical feeding
★ Hydraulically-balanced diaphragm head . . . isolates chemical solutions
★ Continuously adjustable while in operation
★ Sealed-in lubrication . . . long life . . . low maintenance
★ Multiple head and flow proportional units

Write for descriptive bulletin No. 242

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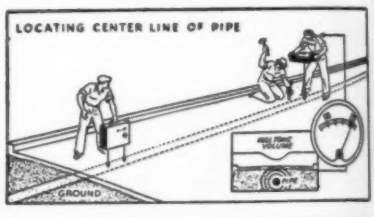
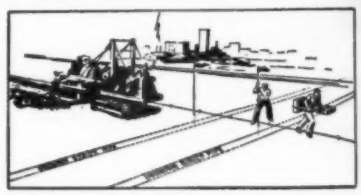
PROCESS EQUIPMENT DIV. LEROY N. Y.

M-SCOPE





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16 PAGE BOOKLET FREE UPON REQUEST

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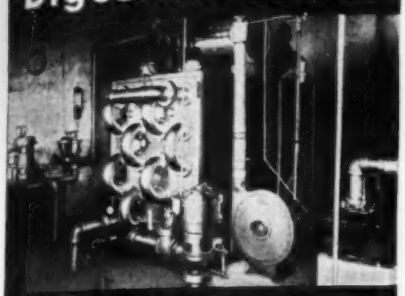
A Better Way of Heating Sludge Digestion Tanks



P.F.T. DIGESTER HEATER AND HEAT EXCHANGER

. . . does away with constantly decreasing heat transfer, greatly reduces the labor of cleaning coils, and minimizes the operating interruptions encountered in the conventional method of heating digestion tanks. Ask for Bulletin 135.

P.F.T. PACIFIC FLUSH TANK CO.
4241 RAVENSWOOD AVE., CHICAGO
NEW YORK • CHARLOTTE, N. C.
SAN FRANCISCO • LOS ANGELES

drick Manufacturing Co., Carbondale, Penna., for Catalog No. 46 if you want something attractive, interesting and educational that will undoubtedly prove helpful to you in some problem in your plant.

Blowers and Exhausters

Bulletin 120-B-13, covering centrifugal blowers and exhausters, has been issued by Roots-Connersville Blower Corp. under the intriguing title of **Let's Look at the Record of R-C Blower Dualability.**

This eight page folder in two colors stresses the wide range of applications where R-C Centrifugals have or may be used, including water and sewage works.

Write Roots-Connersville Blower Corp., Connersville, Ind., for Bulletin 120-B-13.

Model 40 Controller

Bulletin 381, now available from the Foxboro Co., describes **Model 40 Controller,** the newest addition to the company's line of instruments for process control. Illustrations and text explain many features of design which make the Model 40 an unusual instrument. Indicating models as well as single- and multiple-pen recorders are shown and the five types of control action available in the Model 40 are explained.

Copies of the bulletin may be obtained by writing the Foxboro Co., Foxboro, Mass.

Vertical Centrifugal Pump

A six page folder bulletin has been issued by the Peerless Pump Division, Food Machinery Corp., on the construction, design, and application of three types of **Peerless Vertical Centrifugal Pumps.** These pumps as shown in the bulletin are for general purpose pumping in a wide variety of industrial services such as sump and drainage pumping, general water supply, mine station service, cooling tower service, and others.

All three types of pumps develop capacities from 200 to 5000 gpm. and will pump against heads from 20 to 100 ft. The bulletin illustrates all three types of pumps, including comprehensive parts diagrams.

Copies of Bulletin B-137 may be obtained by writing to the Peerless Pump Division, Food Machinery Corp., 301 West Avenue 26, Los Angeles 31, Calif.

LEADITE
The Pioneer Self-Caulking Material for C.I. Pipe

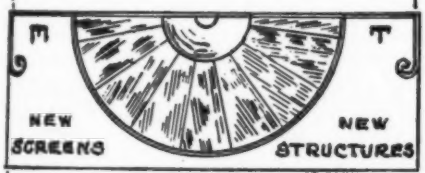
40 YEARS PROVE IT!

• Tested and used by engineers, water works men and contractors for more than 40 years, LEADITE has proved its dependability under most every condition of water main construction . . . proved that it makes a good tight lasting joint that improves with age.

THE LEADITE COMPANY
Girard Trust Co. Bldg., Philadelphia, Pa.

No Caulking

FINE SCREENS
FOR
SEWAGE
AND
INDUSTRIAL WASTES
TREATMENT



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NO COSTLY, POWER CONSUMING REVOLVING BRUSH ARMS—25% GREATER SUBMERGED AREA.

NEW SCREEN PLATES FOR THE ECONOMICAL USE OF A FILTER MEDIA ON THE SCREEN, THUS INSURING GREATER REMOVALS THAN POSSIBLE HITHERTO.

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MODERN DESIGN
HIGHEST EFFICIENCIES
LOWEST COST

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DESIGNERS — CONSULTANTS

FOR BETTER
pH Control
and WATER TESTS
there is nothing like

NON-FADING
GLASS COLOR
STANDARDS

Pocket Comparator No. 605

Permanent reliability of Hellige Glass Color Standards, accuracy of color comparison, simplicity of the technique, and compactness of the apparatus are exclusive features of Hellige Comparators not found in any similar outfits.

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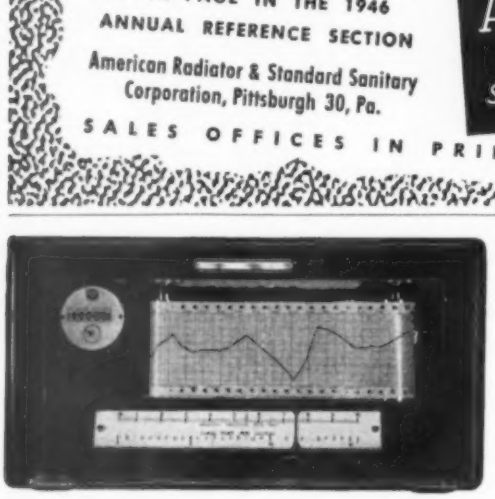
INCORPORATED
3718 NORTHERN BLVD. LONG ISLAND CITY 1, N.Y.
HEADQUARTERS FOR COLORIMETRIC APPARATUS

AMERICAN GAS BOILERS
STEAM AND WATER TYPES
for Digester Heating
FOR RATINGS AND DATA SEE OUR PAGE IN THE 1946 ANNUAL REFERENCE SECTION
American Radiator & Standard Sanitary Corporation, Pittsburgh 30, Pa.
SALES OFFICES IN PRINCIPAL CITIES
AMERICAN-Standard
HEATING PLUMBING
Serving the Nations' Health and Comfort



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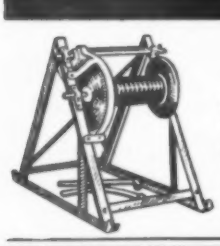
METERS
for
Consistent Accuracy
Bulletin 309 comes upon request.
SPARLING
Manufacturer of Water Measuring Equipment
LOS ANGELES • CINCINNATI • CHICAGO • NEW YORK • BOSTON

Your
PIPE CLEANING
PROBLEMS SOLVED



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Frame. Sturdy angle iron construction. Cable drum holds 1100 ft. of 3/8" cable. Shipping weight without cable 250 lbs.

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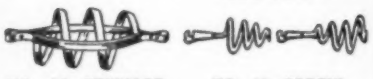

NO. 9A STEWART WELDED ROOT CUTTER
NO. 11—SCREW
NO. 22—SPEAR SCREW
For information write for catalog.
Canadian Distributors: W. H. Cunningham & Hill Ltd., Toronto.
W.H. STEWART
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MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

KNOWN AROUND THE WORLD AS THE SIGN OF EXCELLENCE IN WATER TREATMENT EQUIPMENT

The years of experience behind the Roberts nameplate is your assurance that any water rectification problem is expertly handled to your best advantage. As manufacturing and installation engineers, the Roberts organization is equipped to meet your exact needs regardless of the size of the equipment or the complexity of the problem.

GRAVITY FILTERS • SOFTENING PLANTS AND EQUIPMENT • PRESSURE FILTERS ZEOLITE SOFTENERS • SWIMMING POOL RECIRCULATING APPARATUS SPECIAL WATER TREATMENT EQUIPMENT

We invite your inquiries
ROBERTS FILTER MANUFACTURING COMPANY • Darby, Pa.

Automatic Hypochlorinator

A positive displacement proportioning feeder, **Type Sp Automatic Hypochlorinator,** as manufactured by Wilson Chemical Feeders, Inc., is described in Bulletin No. 1446. The bulletin shows by cutaway diagram how this hypochlorinator operates from the venturi principle. The outstanding features of the Type SP are its applicability to any water supply up to 1.5 mgd.; its visible feed and adjustable dosage in proportion to the flow or consumption of water; its actuation by flow in water in the main; its functioning on any pressure from 5 to 150 lb.; no power required; no moving parts; no lubrication.

This bulletin, No. 1446, may be obtained by writing Wilson Chemical Feeders, Inc,, 205 Clinton St., Buffalo 5, N. Y.

Heat Loss Control

The Industrial Mineral Wool Institute has published a 20-page manual called **Control of Industrial Heat and Power Losses,** which gives nine case histories of fuel cost savings resulting from proper insulation of piping, flanges, drum-heads, driers, boilers, and other hot surfaces.

Typical applications are described in detail, with simple formulae for determining heat losses, and tables of necessary data for using the formulae. The booklet is supplemented with a "Heat Loss Estimate Sheet" for the reader's use in calculating heat losses from his own equipment.

Copies of this brochure may be obtained without charge from the Industrial Mineral Wool Institute, 441 Lexington Ave., New York 17, N. Y.

Automatic Water Sampler

According to a four page folder, **You can improve your water supply with the Stuart-Brumley Automatic Sampler.** The folder shows pictures of the new sampler, tells how it works and why it should be used in sampling water supplies. There are various sizes of the sampler, from one which will collect one composite sample over a twenty-four hour period to those which will collect twelve two-hour composite samples with ten-second intervals in the selection of the sample.

Write to Stuart-Brumley Corp., 516 N. Charles St., Baltimore 1, Md., for this bulletin and other information on the automatic water sampler.

Pump Valves

Designed to illustrate the wide application of Durabla valve units for reciprocating pumps and Diesel engines, Durabla Catalog No. 920, **Pump Valve Service,** has just been published and can be obtained from Durabla Manufacturing Co., 114 Liberty Street, New York 6, N. Y.

Fire Hydrants, Valves

In Catalog No. 15, the **Traverse City Manual** issued by the Traverse City Iron Works presents their Fire Hydrants, Valves, and Water Works Specials. The 112 page manual is a catalog of A. W. W. A. bell and spigot fittings, short bell and spigot fittings, flange fittings, gate valves, indicator posts, check valves, special pipe and pipe fittings and valves, for water and sewage works.

Write Traverse City Iron Works, 121-151 Lake Avenue, Traverse City, Mich., for a copy of Catalog No. 15.

Remote Indication and Control Systems

Remote indicating and control systems, what they are and what they are capable of accomplishing, are explained in a 12 page bulletin released by Allis-Chalmers Mfg. Co., Milwaukee.

By means of photos, diagrams, and charts, the bulletin shows how the transmitter, receiver, and indicator of such systems are constructed, how they work, and their important advantages. These systems have been used in a great variety of applications and jobs utilizing valves, rheostats, potentiometers, governors, switching devices, and combination sequence controls, as well as indicating systems and remote signalling.

Although basically a direct current device, it can be operated on alternating current by addition of a small rectifier unit. A copy of this bulletin 14-B-6641 is available on request from Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.

Storage Tanks and Plastic Pumps

If, in your laboratory, experimental pilot plant, or chemical coagulation system you need glass lined or stainless steel storage tanks, mixing equipment, or a plastic pump that is really corrosion resistant, then you might well be interested in these products manufactured by Ertel Engineering Corp. of Kingston, N. Y.

These plastic pumps are suitable for handling hot corrosive liquids

Leopold

GLAZED FIRE CLAY TILE FILTER BOTTOM

Non-Corrosive—Permanent

DRY CHEMICAL FEEDERS

Accurate—Dependable

also

COMPLETE WATER TREATMENT EQUIPMENT

F. B. LEOPOLD CO., INC.

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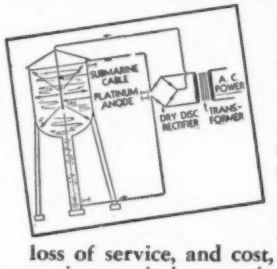
for CONCRETE *and* STEEL!

Inertol
Protection
Means Lowest Cost
Per Year

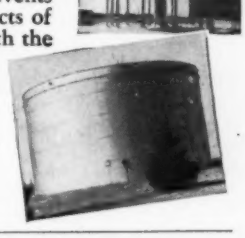
INERTOL COMPANY, INC. NEWARK 5, NEW JERSEY and SAN FRANCISCO 7, CALIFORNIA

RUSTA RESTOR *Prevents Rusting*



Modern, Service-Proved Cathodic Method Gives Lasting Protection Against Rusting—Minimizes Tank Maintenance—Costs Only Two Mills ($0.002) Per Year Per Square Foot of Surface Protected.

Approved and endorsed by national and state authorities, Rusta Restor, the modern cathodic method, maintains the tank in a "neutralized" state that not only prevents rusting but also removes the products of any earlier rusting. It eliminates both the loss of service, and cost, of interior painting. Rusta Restor equipment is inexpensive to install, and cheap to operate. Used from coast-to-coast. Send for full details today.



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★ SAFE ★ RELIABLE ★ QUICK ★

By

The Dean Truck Mounted Valve Operator

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VOGT BROTHERS MFG. CO. Incorporated LOUISVILLE KY.
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AERO-MIX

AERATOR—MIXER

A Size and Type to Fit Your Problem In Water or Sewage Treatment.

WRITE FOR INFORMATION

up to 120 deg. F., are self priming, and equipped with built-in stainless steel manual by-pass and pressure flow control. These pumps will deliver from one to 30 gal. per min. The company also makes a portable pump unit of bronze alloy with V-belt Motor Drive connected, all mounted on caster equipped base. Capacity 1 to 30 gpm.

These pieces of equipment are described in Cat. 12, **Liquid Handling Equipment,** issued by Ertel Engineering Corp., Kingston, N. Y.

Small High Pressure Pumps

If you are interested in **Small High Pressure Pumps** for pressures up to 200 psi., you may be interested in writing to the Economy Pumps, Inc., Hamilton, Ohio, for their most recent bulletin, Cat. No. D446, in which these small pumps suitable for boiler feed and many industrial uses are described.

Chemical Feed Systems

The Milton Roy Co. of 1300 Mermaid Ave., Philadelphia 18, Pa., has issued Bulletin No. 468 describing **Controlled Volume Chemical Pumps, Automatic Chemical Feed Systems,** in which are described automatic

FOR SALE
1000 ft. NEW 36 Inch
CAST IRON BELL
AND SPIGOT PIPE
CLASS "C"

Immediate Delivery

Write—Wire—Phone

SONKEN
GALAMBA
CORP.

2nd & Riverview—Victor 9243
Kansas City 18, Kansas

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933

Of Water and Sewage Works, published monthly at Chicago, Ill., for Oct. 1, 1946.

State of Illinois, County of Cook, ss.—

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Edward S. Gillette, who, having been duly sworn according to law, deposes and says that he is the publisher of the Water and Sewage Works and that the following is, to the best of his knowledge and belief, a true statement of the ownership management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to-wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher—Edward S. Gillette, 22 West Maple St., Chicago 10, Ill.

Editor—L. H. Enslow, 155 East 44th St., New York 17, N. Y.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.)

Gillette Publishing Company, 22 West Maple St., Chicago 10, Illinois.

Edward S. Gillette, 22 West Maple St., Chicago 10, Illinois.
L. H. Enslow, 155 East 44th St., New York 17, N. Y.
H. P. Gillette, 22 West Maple St., Chicago 10, Illinois.
Winifred Gillette, 1125 Oak Grove Ave., San Marino, Calif.
Mrs. R. W. Hume, 303 South Stone Ave., La Grange, Ill.
Louise E. Forsythe, 410 Thayer Road, Swarthmore, Pa.
Provident Trust Company, 17th & Chestnut Streets, Philadelphia, Pa.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds mortgages, or other securities are: (If there are none, so state.)

None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is—. (This information is required from daily publications only.)

EDWARD S. GILLETTE,
Publisher.

Sworn to and subscribed before me this 17th day of October, 1946.

(Seal)

CLARE MEHL,
Notary Public.
(My commission expires December 19, 1948.)

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JOINT LEAKAGE
WITH
CARSON CLAMPS
AND MECHANICAL JOINTS
Charcoal iron bolts for Cast Iron Pipe and Fittings.
Write for Prices.
Carson-Cadillac Co.
1221 PINSON ST. BIRMINGHAM, ALA.

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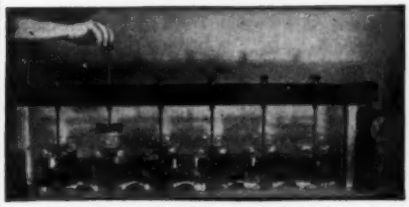
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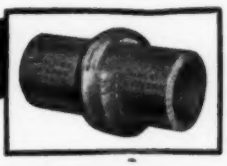
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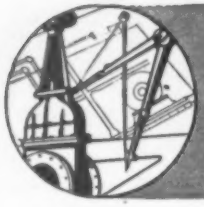

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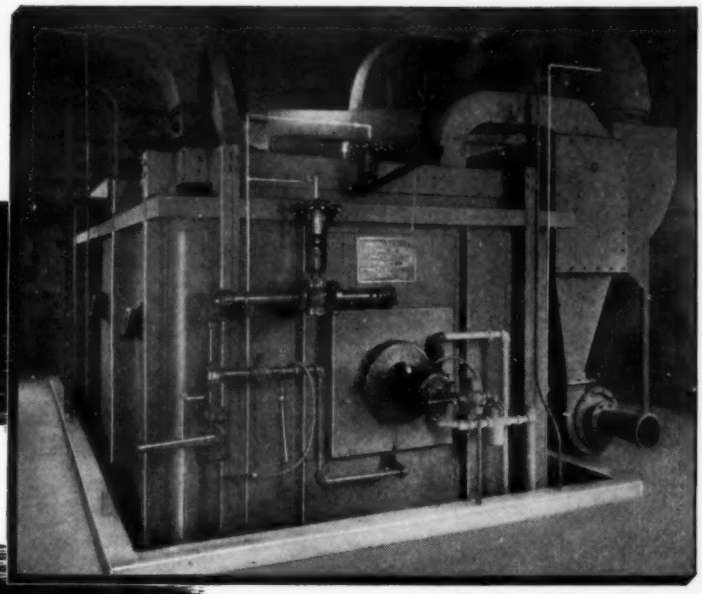

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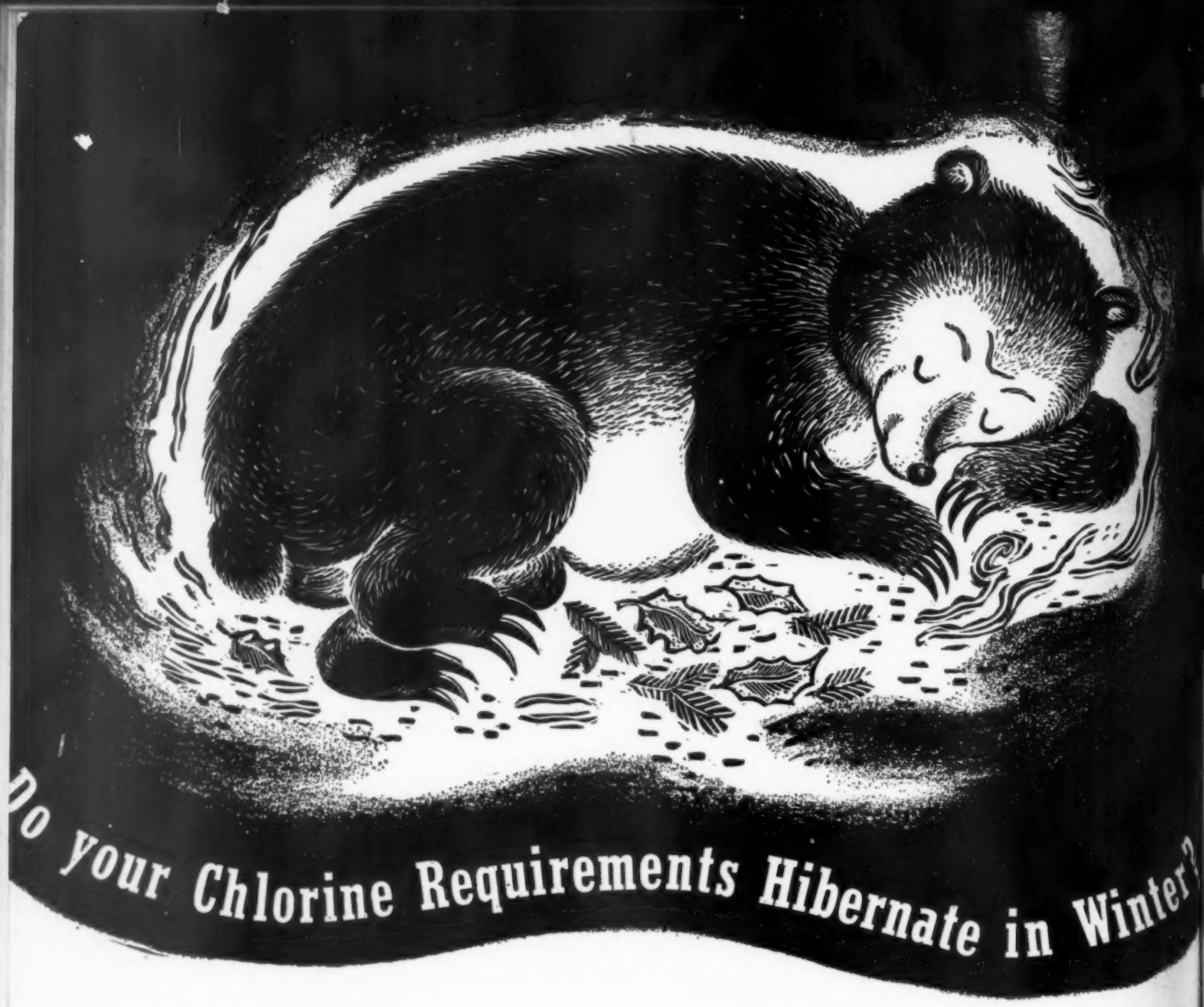
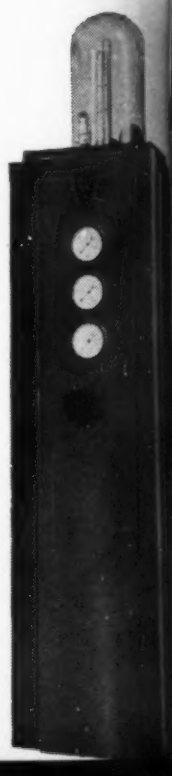


Do your Chlorine Requirements Hibernate in Winter?

If your chlorine requirements hibernate in winter — or any other season for that matter — so that the equipment stands idle for long periods and is then called upon for immediate service — you need a W & T Visible Vacuum Chlorinator. Like the bear it's built for hard intermittent service. Use it when it's needed and then just shut it off and forget it until the next time. With only ordinary care it will always be ready and waiting.

W & T Visible Vacuum Chlorinators have no delicate mechanisms to get out of order or "freeze up" during extended shut down periods — nor do they need to be "coddled" or given special treatment when taken out of service. Simple precautions that you'd give any piece of mechanical equipment, sure—but packing away in moth balls—no.

Why not call your W & T Representative today — he'll be glad to give you further details on W & T Chlorinators for odor control, effluent chlorination and many other sewage plant needs.



"The Only Safe Sewage is a Sterilized Sewage"

WALLACE & TIERNAN COMPANY, INC.

MANUFACTURERS OF CHLORINE AND AMMONIA CONTROL APPARATUS
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